

P  
136  
3

CAPE OF GOOD HOPE.

---

---

Ministerial Department of Crown Lands and Public Works.

---

---

REPORTS

BY THE

INSPECTORS OF DIAMOND MINES

IN THE LATE PROVINCE OF

GRIQUALAND WEST

For the Year 1889.

---

---

Presented to both Houses of Parliament by command of His Excellency the Governor.

1890.

---

---

CAPE TOWN:

W. A. RICHARDS & SONS, GOVERNMENT PRINTERS.

1890.

[G. 11—'90.]







JSL  
00071207

A/7209  
1890 report  
5 colored plates  
(+ 1 black)  
R525

# CAPE OF GOOD HOPE.

---

Ministerial Department of Crown Lands and Public Works.

---

## REPORTS

BY THE

## INSPECTORS OF DIAMOND MINES

IN THE LATE PROVINCE OF

## GRIQUALAND WEST

For the Year 1889.

---

Presented to both Houses of Parliament by command of His Excellency the Governor.

1890.

---

CAPE TOWN:

W. A. RICHARDS & SONS, GOVERNMENT PRINTERS.

1890.

[G. 11—'90.]



THE HISTORY OF THE

REIGN OF THE

EMPEROR

OF THE

OF THE

OF THE

OF THE

OF THE

OF THE



## CAPE OF GOOD HOPE.

### Report of the Inspector of Diamond Mines for the Year 1889.

Presented to both Houses of Parliament by command of His Excellency the Governor.

1890.

#### REPORT OF THE INSPECTOR OF MINES, KIMBERLEY, FOR THE YEAR 1889.

Up to and including the year 1880 no Inspector's report upon the mining industry was framed, and I regret that I am therefore unable to furnish any historical or other information for 1880 apart from the few statistics included in the tables herewith.

It will be unnecessary for the purposes of this brief history of the industry for the past decade to refer particularly to other than the four principal mines, viz., the Kimberley, De Beer's, Du Toit's Pan and Bultfontein.

When I was appointed (1st October, 1881) to the supervision of Diamond Mines on the Vooruitzicht Estate, the system of mining in general vogue was "open working," that is, simply as in an open quarry.

*Doubts as to Permanence of Industry.*—Even then, in 1881, some claim-holders did not seem at all confident about the permanence of the industry. Many had the idea that the diamondiferous ground had been deposited in some inexplicable manner in various holes or cups in the earth's surface. The probability of the diamondiferous magma being a true mine rock contained within the pipe of the producing volcano was then opposed and even ridiculed by some of the diggers of the period.

The depth attained in the deepest workings in about the middle of the Kimberley Mine, some 400 feet from the red soil surface in 1881, and the discovery of the containing rock on the north side at about 260 feet from surface, however, served to convince reasonable men that the diamond mines were of volcanic origin, and that they were permanent as contrasted with diamondiferous alluviums.

The "yellow" ground had by this time been passed through in all four mines, operations in the "blue" were general, and it became evident that the yellow colour and friable nature of the upper portion of the diamondiferous rock were clearly owing to atmospheric and other natural influences.

*"Yellow" Ground.*—The "yellow," owing to its friable and easily disintegrating character, was treated in the washing machine directly on its being hauled from the mine; but the "blue" was found to be much tougher and harder, especially as greater depth was reached, and had to be exposed to the weather, in order that it might pulverise and so be brought into a fit state for washing.

[G 11.—'90.]

B



*"Blue" Ground.*—On reaching the "blue," therefore, the depositing floors were brought into constant use, and upon these it was spread out from 9 to 12 inches in thickness, and, in dry seasons, was subjected to occasional waterings, in order to hasten the disintegration of the minerals.

*Early Washing.*—The system of washing as described in my report for 1881 [G. 27—'82] is essentially the same to-day, but in sundry details, and notably in the size of machines and excellence of the machinery, very great improvements have been introduced.

The earlier washing gears, being practically experimental, did not perfectly, or at least satisfactorily, fulfil their duties, and in many instances it was found that a considerable loss was sustained in diamonds thrown out in the "tailings," through the imperfect performance of the early washing pans. To-day large quantities of "old-day" dry sortings and of the "tailings" from ill-designed machines are re-washed, and found to pay for the re-treatment.

1881.—*Falls of Main Reef.*—In Kimberley Mine enormous falls of main reef had already taken place, and to some extent also in De Beer's, but in the Du Toit's Pan and Bultfontein Mines the operations in claim ground had not yet greatly interfered with the integrity of the marginal reef. The horizontal distance from the reef edge to a vertical over the edge of the "blue" about 200 feet below in the Kimberley Mine was, in December, 1881, over 300 feet on the south, and nearly 250 feet on the north sides of the mines, caused by falls of the marginal reef up to that time. On the east the slope was also considerable, but on the west the surrounding reef had not been reached. From Kimberley Mine 1,665,258 leads of main reef were removed at a cost of £211,821 during the year 1881, and up to the end of that year the total of reef removed from De Beer's Mine is given at 407,482 loads. *Vide* note at foot of page 7 in Report for 1882 [G. 34—'83].

*System of Hauling Shafts.*—In the Kimberley Mine three systems of hauling were adopted, viz., by aerial gears, by open inclines, and through vertical shafts. A fine shaft on the south side, sunk by the French Diamond Mining Company, was utilized for hauling reef in the operations for terracing or sloping back the marginal reef; this shaft was sunk to a depth of 290 feet with a water sump of 7 feet further just on the surface of the "hard rock," which on this side of the mine is at about 300 feet from the shaft flat sheet, or 275 from red soil surface (the old débris lying on the surface is from 20 to 30 feet deep, surrounding the open mine). The reef (black shale principally) was excavated in the "open," and shot down "passes" to the tunnels connecting with the bottom of the shaft. A shaft on the north side by the Central Diamond Mining Company, sunk to a depth of 280 feet from débris surface, was employed by means of a tunnel into the mine at 200 feet depth for hauling reef, and by another tunnel at bottom driven into the "blue" for hauling the diamondiferous rock. The operations by means of these shafts were carried on day and night. On the north-east the Mining Board managing the mine had another shaft sunk to the "hard rock" for the removal of main reef, with hauling gear complete, but it was but little if ever used.

A prospecting shaft was in this year sunk in the "blue" on the north side, close down by the "hard rock," to a total depth of 500 feet.

*Inclines.*—An incline tramway, 3 feet 6 inches gauge, was constructed on the eastern margin of the mine, and a considerable area of the main reef on that side was removed by means of locomotives and trucks running on this incline.

*Aerial Gears.*—With the exception of the comparatively insignificant quantity of "blue" hauled through the north shaft, as above stated, the whole of the "blue" raised from the mine was hauled on aerial gears, which were simply tubs slung in carriages running by means of four grooved wheels upon double standing wires.

In De Beer's Mine, on the east side, there was an excellent outside shaft,



9 feet by 9 feet 6 inches, sunk to a depth of 150 feet, and connected with the mine by a tunnel 540 feet in length.

The "blue," howsoever hauled, was conveyed from the delivery boxes at the surface edge of the mine to the depositing floors in trucks running on light railways and drawn by horses, or in ordinary carts.

*Drainage.*—The mine water was led to a central reservoir in the lowest part of the claim workings, whence it was raised in tubs or trucks running on aerial standing wires. The water removal tariff in Kimberley Mine was 6d. per 100 gallons, and over 50,000 gallons were hauled in the twenty-four hours, and allowed to run to a neighbouring vley. In the De Beer's Mine the water contractor (one of the claimholders) hauled the mine water for £900 per month, and used it for his own purposes.

*Electric Light.*—The electric light was introduced for mining operations in the Kimberley Mine, where it was used in the claims and on the margin at the delivery boxes. It was found to be an immense improvement on the old style of lighting by night, viz., paraffin tins filled with waste saturated with paraffin oil.

It may be well to note here some of the prices ruling during this year on the Diamond Fields. The price of a small truck—16 cubic feet—was £25; of a tub of like capacity with its carriage (for aerial gears) £50. Horses were £30 to £40 each, mules £25 to £35, oxen £8. The cost of feeding was each, per week: horses and mules 40s. to 50s., oxen 15s. to 20s.; firewood £10 to £25 per waggon load (8,000 lbs. weight is an average load), English coal £17 10s., and Colonial coal averaged £12 per ton. Water for household purposes was delivered in barrels (126 gallons) for 5s. per barrel.

1882.—*Depth.*—The greatest and average depths in workings by the end of 1882 are given at 420 and 340 feet in the Kimberley Mine, at 260 and 190 feet in De Beer's; the greatest depth at 197 feet in Du Toit's Pan, and the average in the Bultfontein Mine at 126 feet from the surface red soils.

*Pipe Rock.*—In the Kimberley Mine the "hard rock" was laid bare on the north to a depth of 90 feet, and exposed for 200 feet laterally along its upper edge. For the 90 feet this pipe rock encroaches 1 in 12 into the "blue," and so continues to a depth of 200 feet from its upper edge, but thereafter, as was then found by means of a trial shaft, it falls vertically for a short distance, and then recedes at about the same angle as that of its encroachment. Upon the south it was also discovered during this year in tunnels at two points, and similarly upon the east.

*Panorama.*—The idea of surface deposition was now quite abandoned, and the true mine character of these diamondiferous sources was generally admitted. In the De Beer's, Du Toit's Pan, and Bultfontein Mines the containing pipe rock had not been discovered, but the true mine features were otherwise equally evident in them all.

The yield per load of the ground from the four mines could not yet be fairly compared, as the Kimberley was "all over" in "blue," the De Beer's principally in "blue," while the Du Toit's Pan and Bultfontein were as yet only partially beyond the "yellow," and the richness was found to increase in the "blue" as compared with "yellow." The yield, however, as estimated for 1882, were  $1\frac{1}{2}$  carats from Kimberley "blue," 1 carat from De Beer's "blue,"  $\frac{1}{4}$  of a carat from Du Toit's Pan ground, and at  $\frac{1}{3}$  of a carat per load from Bultfontein ground—whether from the "blue" or from the "yellow" or as a general average, is not stated in the reports on these two mines. The comparative *qualities* of the gems realised were, however, in favour of Du Toit's Pan stuff, Bultfontein, Kimberley and De Beer's following in order.

*Main Reef.*—During September, 1882, a large area of the eastern marginal reef of the Kimberley Mine subsided, reducing the width of the public roadway there to about 12 or 15 feet.

The black shale portion of the main reef during the action of subsidence undergoes combustion from the great quantity of sulphur pyrites contained in



it. While so burning, considerable volumes of suffocating fumes are given off, and the shale suffering combustion becomes so hot that from these causes the work of removal is carried out with difficulty and great physical distress to the persons engaged in the work. The black shale closely resembles in appearance the ordinary black shales of the coal measures, and burns to a dull rich red.

During this year nearly 3,000,000 loads of main reef were removed from the margin of the Kimberley Mine, at a cost of close on £530,000.

The work of removal of main reef went on steadily during this year by means of two inclines, 18 inch gauge, at the west margin, one new reef-shaft at the north-east, one 3 feet 6 inch gauge (locomotive) incline at the east, and by means of carts at the south-east, altogether employing daily about 30 white men, 330 Kaffirs, and 40 horses and mules, and yielding a daily return of 2,700 loads of 16 cubic feet reef hauled. The principal reef removal operations were, however, carried on through two outside shafts, one on the north and the other on the south side of the mine, and by different aerial gears.

In De Beer's Mine the quantity of main reef removed from 1st October, 1877, to the end of 1882 is returned by the Mining Board at 217,171 cubic yards in *the solid*, equal to about 610,794 loads of 16 cubic feet in the loose. This calculation is based on a load of 16 cubic feet loose being equal to 9.6 feet in the solid.

*Floating Reef.*—A very troublesome and expensive incubus on profitable mining operations in this mine was the "floating reef," that is to say, a huge mass of rock matter contained within the diamondiferous magma. The term "floating reef" very clearly explains the position, as the mass decreases, and is finally got rid of as depth is reached, and the "blue" below is found usually to be of excellent paying quality.

The removal of the "floating reef" is not included in the main reef operations above specified, as it was contained within claim ground and had to be dealt with by the claimholders concerned at their own expense.

In the Du Toit's Pan and Bultfontein Mines the marginal reef had not yet commenced to give trouble, as the workings in claim ground were in both cases very far behind those in the Kimberley and De Beer's Mines as regards depth and comparative extent of operations.

The means of access to and exit from working places in the open-worked mines were—and still are—by means of pathways at suitable positions for the use of Kaffirs, and by the aerial gears for white men.

*Systems.*—A few horse whims were still in use for haulage of the blue at the De Beer's Mine, but the use of steam-power had become general for hauling and washing purposes.

Up to 1874 the raw hide and iron buckets slung on travellers with two grooved wheels running on single standing wires, and hauled up by means of the hand-power windlass, were the appliances in vogue; these were succeeded by the horse-whip and half-aum (small wine-cask of 16 gallons capacity) also slung on similar travellers running on single wires; then the horse-whim and large tub ( $\frac{1}{2}$  hogshead=32 gallons capacity) slung in four-wheeled carriages running on double standing wires; ultimately, about 1880, the steam engine and iron tubs and carriages ousted animal power and wooden vehicles. [The aerial gear in 1887 (Kimberley and De Beer's Mines) finally yielded to shafts furnished with skips or cages, for deep workings, and open working was abandoned in favour of underground mining.]

*Drainage.*—In the Kimberley Mine the average daily quantity of mine water raised was 33,000 gallons, at a cost, as previously, of 6d. per 100 gallons; in the De Beer's Mine the daily quantity was about 35,000 gallons, at a monthly charge, as in 1881, of £900, paid to the contractors; in Du Toit's Pan the discharge is stated at 5,000 gallons per hour, pumping day and night all the year round, equal to 120,000 gallons per 24 hours; in Bult-



fontein the mine water was not a source of trouble, and no special arrangements were made for removal of the small quantities which percolated into that mine.

*Machinery.*—As the Assistant Inspector of Machinery makes for the year 1882 his first descriptive report on machinery used in the industry, it will be suitable to insert here extracts from that report, of the main features of the mining machinery.

(*Extract from Report on 1882*).

“I consider the character of the machinery at Du Toit’s Pan and Bultfontein Mines as generally suitable for the work to be dealt with, though, in the case of the inclined aerial hauling gears, they are more precarious and uneconomical in regard to amount of fuel used in comparison with average results obtained in the systems usual in other parts of the world of hauling up vertical shafts.

“The general quality and workmanship of the engines and boilers mostly in vogue here, *i.e.*, semi-portable multitubular boilers of the locomotive type, with engines both combined and separate, when new, are usually equal to fair, and sometimes the best English practice, but they deteriorate, owing to inattention to inward cleaning (I refer especially to boilers) much faster than the weakening effects of corrosion and wear and tear ordinarily affects them.

“The water available for feed water in this district is very highly charged with lime, which deposits in dangerous amount in the boilers very quickly; thus I have to find fault with neglect of systematic examination by companies of the interior of boilers.”

\* \* \* \* \*

“I estimate that probably not one half of the engine-drivers, boiler attendants, &c., employed at these mines would pass muster for such employment in England.”

\* \* \* \* \*

“Within the mines themselves (1) the wire-rope roadways stretched from the surface of the mine to their anchorings at the working levels of the claims below; (2) the tramways at the bottom of the mine; and (3) a few pumping engines, constitute the machinery; but at the surface of the mines, and disposed generally all the way round with varying distances of from say 100 feet to 500 feet from the edge of the mine, are situated the mass of hauling engines and their gears, &c. From here the depositing floors reach right away in some cases to distances over two miles from the mine.

“The sites of the washing engines, as also of the steam pumping-engines, which latter are required for watering purposes on the depositing floors, for feeding the boilers, and supplying the large quantities of water used by the washing machine, are generally fixed in the far boundaries of these depositing areas. Tramways traverse these floors in all directions, and locomotive power, used instead of horses, mules, or oxen, for dragging the vast number of truck-loads of blue ground or reef from the mine to their respective tipping-places, is gradually extending with beneficial results.

“For purposes of reference, and to avoid unnecessary repetition, I may add that a description in detail of the methods of working, as also the different processes the diamondiferous ground won in the mines passes through by the systems that obtain at present on the diamond fields, is generally described by the Inspector of Mines on the ‘Vooruitzicht Estate’ in his Report published in a Blue-book of 1882 [G. 27—82].

“The machinery in general use, then, in diamond mining operations, may be tabulated as follows:—

“1.—*Hauling Gears*, which are on the following three different systems:

(a) Winding engines, pulling cages containing trucks filled with ground up vertical shafts.

(b) Winding engines, pulling loaded trucks up inclined tramways.



(c) Winding engines, pulling (1) 'tub-carriages' or (2) 'sling carriages,' containing a loaded truck, up inclined aerial rope-ways.

"These gears include the use of steam engines, boilers, and wire ropes for the following distinctly different purposes, *i.e.*, guide ropes (in shafts) 'standing wires' (in aerial gears), and 'hauling wires' (in every system), together with all the paraphernalia required in making stout connections of the standing wires to moorings on the surface of the mine, and firm anchorings for these wires at the bottom of the mine, with all the intermediate supporting standards to maintain the rope-way gauge, and keep the standing wires in position.

"2.—*Washing Gears*, including engines, boilers, elevators, pulsators, rotary puddling machines, &c., &c. (described in Report already referred to in Blue-book G. 27—'82).

"3.—*Pumping Gears*, and miscellaneous stationary engines, boilers, &c., of various types.

"4.—*Locomotive engines and permanent way.*"

\* \* \* \* \*

"When the 'blue' has been deposited on the floor, it is picked by gangs of Kaffirs, under the supervision of overseers, one overseer watching a gang of six or eight boys.

"The large lumps are set on end that they may be the better exposed to the influences of the atmosphere.

"The process of disintegration requires from one month to four months, depending on the season and the weather. Pounding with picks and watering are means resorted to in order to hasten the pulverisation of the 'blue.'

"A description of one of the modern washing machines will suffice for all.

"When sufficiently reduced, the 'blue' is taken to the washing machine, which may be described as an immense pan from 9 to 12 feet diameter, with outer and inner walls about 12 inches high. Between these walls an armature, carrying knives and pins, revolves.

"The blue ground is first thrown on a bar grating, which separates the large stones from diamondiferous soil.

"On passing through this grating, which is on ground level, the 'blue' is carried up by the dry elevator to a hopper, whence it passes to a revolving cylinder set at a slight angle, the first half of which is of sheet iron. The lower end is simply a riddle of very coarse mesh, which arrests the large gravel, ejecting it into a shoot, by which it is conveyed to the wet elevator. A stream of water runs through this cylinder, and a spray of water constantly plays over the riddle end.

"On entering the sheet-iron half of the revolving cylinder, the ground is thoroughly mixed up with the stream of water, and in the riddle portion it gets rid of the large gravel. The spray of water prevents the ground from adhering to the meshes.

"Passing through the meshes of the riddle, the ground is caught by a sheet-iron casing below, and conducted to the pan, and therein, in the consistence of thick cream or thin plaster, it is continually divided and mixed by the revolving armature of knives and pins.

"On the inner side of the pan there is a gate cut, to allow of the light stuff, which contains no diamonds, escaping by a shoot to the wet elevator, by which, with the gravel already mentioned, it is carried up and thrown on a bar screen, which allows the water to return to the pan, while *débris* or 'tailings' are thrown out.

"The diamonds, being heavy, remain at the bottom of the pan, and after the day's washing is over, or sooner, if necessary, the machine is stopped, and the pan emptied of the heavy stuff into a large iron tank kept securely padlocked.

"The next process is termed 'washing-up,' which is done by means of



a cradle oscillating trays, or a pulsator. In each of these there are series of graduated mesh.

"The heavy stuff, as taken out of the tank, is run again through a cylindrical screen, on which a spray of water plays.

"The coarse deposit is thus separated and thrown on to a table, and then sorted, in case of large diamonds being present.

"The remainder, which has passed through the meshes of the revolving screens, runs into one or other of the machines just mentioned, in which it is thoroughly washed with clean water; by a peculiar action it is being ceaselessly shaken so as to throw the heaviest minerals to the bottom, and towards one end, usually, of each tray or sieve. When thoroughly cleansed, the top, or light stuff, is carefully removed, leaving what is technically termed the 'heavy deposit,' in which are to be found the diamonds. The trays are then turned over on sorting tables, where the deposit is 'sorted' with a metal scraper, and the diamonds picked out.

"The largest, but not, necessarily, the most valuable, stones are generally found before they can reach the sorting tables, during the operation of picking in the claims and on the floors, and it is there that thieving generally takes place.

"The general type of engine and boiler used in the mining industry of Griqualand West, both for hauling and washing purposes, is that known as the semi-portable engine with multitubular locomotive boiler combined; but in a large number of cases the engine is separate from the boiler, and on a distinct foundation, but with similar boiler as above, and this latter arrangement possesses some apparent advantages.

"The locomotive type of boiler undoubtedly in most particulars suits the requirements of the Diamond Fields admirably; it is economical as regards its steaming qualities, and it is well adapted for using such varieties of fuel as exists here, viz., wood, coal, and cow-dung."

\* \* \* \* \*

"The hauling engines are, with very few exceptions, double cylinder, are geared with a single winding-drum, and fitted with link-motion reversing gear.

"Their size varies generally between 8 nominal horse-power and 25 nominal horse-power, and they are generally adapted for a working pressure of from 60 lb. to 90 lb. on the square inch."

\* \* \* \* \*

"The washing engines are, as a rule, the ordinary single cylinder semi-portable engines and multitubular boiler combined, including all the usual types of this class, and vary generally between 6 nominal horse-power and 20 nominal horse-power.

"The boilers are usually adapted for a pressure of 60 lb. on the square inch, but more frequently than not, when the boiler is kept in an efficient state as regards cleanliness, not much more than half that pressure is found equal to the work required from it for actually driving the rotary washing machines, elevators, &c.; in other words, the available power is frequently in excess of the work it has been set to perform, and in many cases additional work has been added in the driving of geared pumps, pulsators, circular saws (for cutting up firewood) or the driving lathes, and other tools in the workshops, where repairs to the machinery of the company are effected.

"The majority of the engines specially used for pumping water from the 'pans' or 'vleys' for the various purposes of watering the blue ground on the floors or feeding boilers, as also the machines used in washing operations, are generally only of small power, varying from 4 nominal horse-power to 8 nominal horse-power. A usual type is a vertical multitubular or a cross-tubed boiler with engine fixed on the same bed-plate, and driving, by means of a wire-rope, a double-action pump mounted on a bed-plate and fitted with a crank shaft, &c., fixed in a suitable position to draw the water.



"Besides these engines there are a number of direct-acting steam-pumps used in all the mines, varying in size up to 16" diameter of steam cylinders, with an 8" diameter of water cylinder, and capable of pumping up to about 12,000 gallons per hour.

"Locomotive engines are used by six firms in the four mines under notice, and probably it is only the extravagant cost of fuel that prevents their more general adoption in lieu of horses, mules, &c."

\* \* \* \* \*

"The woods used for firing boilers are the Kameelhout and the Olivenhout, the former in great preponderance, but the latter is incomparably better wood for steaming purposes."

\* \* \* \* \*

"I have reckoned out the annual expenditure in fuel at present at the four mines, as approaching £600,000, and the amount of Welsh coal that would steam the boilers at the present output of work, at 55,000 tons per annum."

*Electric Lighting.*—The electric light was this year introduced for street lighting in Kimberley.

*Depth.*—The depth of the Kimberley Mine increased but little during 1883, owing to the numerous and heavy falls of marginal reef which took place during that period. In the De Beer's Mine the greatest depth in open workings had reached 300 feet from the red soil; on the north side a test shaft had been sunk down by the edge of the "hard rock" (similar in character to the pipe rock in the Kimberley Mine) to a depth of over 350 feet from surface; in Bultfontein Mine the average depth attained is stated at 150 feet.

*Yellow.*—In the De Beer's Mine operations had passed generally beyond the "yellow," very little of which was hauled for washing purposes. In the Du Toit's Pan and Bultfontein Mines the output of "yellow" was steadily giving place to "blue" ground.

Many thousands of loads of "yellow" were excavated, hauled, and tipped as unpayable in the case of the above latter three mines, and so much dead work told with ruinous effect in some instances, but the inferior "yellow" had to be removed in order to get at the richer "blue" below.

*Falls of Main Reef.*—About the beginning of January, 1883, fresh infalls of the marginal reef on the east side of Kimberley Mine took place, and intermittently continued till the end of the following June; the street known as Pniel Road completely fell in at one point, rendering the roadway impassable. On the south-east extensive subsidences occurred in March, April, and August; but the principal fall took place from the north side during November, by which it was estimated that 250,000 cubic yards (about 750,000 loads of 16 cubic feet) had fallen, about one-fifth of which went into claim workings. From July to end of October this main reef had been lightened by the removal of 37,000 cubic yards, with the view of preventing subsidence of reef into claim ground; such lightening may have delayed the fall by a few days. On the south-west and north-east the main reef began to threaten heavy falls in those localities.

In De Beer's Mine there were only two falls of main reef of any consequence: one during April and May on the north side, and a heavy fall of about 40,000 loads reef and "blue" from the north-east side in September. An extensive slip of diamondiferous ground took place in the eastern part of the mine, causing the death of four natives, in November.

*Underground Mining.*—During the year 1883 the first experiment in underground mining in the diamondiferous rock was made. A shaft was sunk in the open mine in claim No. 320, but the tunnels and chambers were driven and made upon neither system nor plan, and the result was great damage to the stability for proper mining afterwards in the claims so honey-combed by the mole-like burrowing.



*Searching System.*—The searching system under Government administration was introduced and elaborated for the much-desired efficient searching of employes, in order to prevent theft of diamonds. Searching-houses were erected at certain points on the margin of each mine, through which the employes had to pass, and in which they were supposed to be thoroughly searched. A staff of searchers, under an inspector, was organized for each mine, under a Government chief officer controlling the whole department. The results of the application of the searching system as thus carried out were not satisfactory. In October a strike among the white miners occurred, the principal grievance being “stripping” of white men in searching-houses, causing an almost total cessation of work at all four mines.

The authorities virtually surrendered the point, and work was shortly resumed. The excitement was great, but little or no damage was done.

*Fire in Shaft.*—On the 4th November the vertical shaft, south side, Kimberley Mine, was destroyed by fire.

*Vaal River Water.*—The Kimberley Waterworks Company, Limited, completed their water system between the Vaal River and Kimberley—a distance of 17 miles—in January, and an ample supply of the river water was rendered available in Kimberley, superseding the unsatisfactory service by means of water-carts, delivering well-water at a cost of 5s. per barrel. The well-water was not always clean, and the cleanliness of the wells received scant attention; the supply, therefore, of good river water, properly filtered, was a welcome and invaluable boon to the population of the Diamond Fields.

The price charged by the company was and is one shilling and three-pence per 100 gallons.

1884.—*Depths.*—The greatest depth attained in 1884 in Kimberley Mine was 520 feet in a shaft sunk from the underground workings; and in claims, 348 feet. Work in the open was very limited, owing to the enormous covering of fallen reef, and from that cause not more than 50 claims were regularly worked during the year. By the end of the year the only rich “blue” exposed and workable in the open system was in about three claims area at the eastern part of the mine. The high standing “blue” at the west end was clear of reef, but was not of payable quality.

In De Beer’s Mine 330 feet was the maximum depth attained in open workings, an increase of 30 feet for the year.

The greatest depth—open working—in Du Toit’s Pan Mine was 287 feet, and in Bultfontein 258 feet.

*Main Reef.*—On 8th September the fallen reef in the Kimberley Mine, which slipped during November of the previous year, as hereinbefore related, subsided still further into and across the claims, destroying the underground workings, which had been developed in connection with the shafts sunk in claim ground, and also a large amount of machinery and gear, estimated at a value of £5,000.

The main reef on the south-west side, which had been showing threatening symptoms for many months, subsided about the end of November of this year, completely covering up a tunnel and shaft in claim 616, constructed for the purpose of working the west end ground on the underground system; the main reef at this quarter continued further falling and subsequent surging across claim ground for weeks afterwards, till it attained its angle of repose, which has been found to be about  $32^{\circ}$ . On the north-east extensive operations had been prosecuted for lightening the main reef there. Over 700,000 loads of marginal reef, standing and fallen, were removed during the twelvemonth.

In De Beer’s Mine a large fall of marginal reef took place in February, estimated at 30,000 loads. The marginal reef in this, as also in the Du Toit’s Pan and Bultfontein Mines, had not yet been exposed to such an extent as had obtained in the Kimberley Mine, and therefore the reef troubles of the last-named had not been paralleled in any of the others.



In the Du Toit's Pan and Bultfontein Mines no reef falls of any magnitude occurred during 1884.

*Diamondiferous Ground.*—Owing to the extensive falls of main reef in the Kimberley Mine, the operations in claim ground had been very limited. The great reef fall of November 4, 1883, and subsequent further subsidence of the fallen reef in September of this year left only about 30 workable claims in the eastern portion of the mine.

A few of the reef-covered claims were cleared for work when the south-west reef and high ground came down in November of this year, and the fallen reef therefrom met and lapped over that already covering claim ground from the north side. The continued subsidence of the southern and south-western reef resulted, as above stated, in leaving only about three claims clear at the east end of the mine by the end of the year.

In De Beer's Mine the high west end "yellow," almost valueless, had been reduced, with the view of preventing, if possible, not too late, any great slip of that unpayable ground into, and stoppage of work in, good claims. The "blue" had been found to increase in richness of yield as depth was attained, and the enormous body of floating reef had been very greatly reduced.

No reef falls of any importance occurred in either the Du Toit's Pan or Bultfontein Mines during this year.

*Mining.*—The underground system of mining was further developed in the Kimberley Mine, but not to any great extent. A new  $22\frac{1}{2}$  feet  $\times$   $7\frac{1}{2}$  feet shaft was commenced on the north side of the mine, nearly 1,000 feet from the edge of the hard rock; and the old shaft ("Atkins") was deepened into the rock, with the intention of driving a tunnel through the rock into the mine, and working extensively on underground methods.

On the north side of De Beer's Mine, about 1,000 feet to the north thereof, a very large and elaborate shaft was begun. It was circular in cross section 21 feet diameter, to be carried down of that size for about 70 feet to the black shale, through which two smaller shafts within the 21 feet circle were to be carried 220 feet down to the hard rock; on that being reached the 21 feet dimensions were to be completed by rising up, and so removing the shale left in sinking the two smaller shafts. Then the shaft was to be lined with accurately cut free stone (brought from the Modder River, some 23 miles distant) from hard rock to surface, reducing the size of the shaft to 18 feet diameter. This shaft was never completed, and the portion sunk (320 feet) was abandoned, and is now fenced in.

In the Du Toit's Pan and Bultfontein Mines open working remained the system in vogue.

*Searching System.*—The searching system was still carried on, and endeavours were made to perfect it as far as possible, but it proved still to be cumbrous and unsatisfactory to all concerned.

*Strike of Employés.*—In April a serious strike was organized against the "stripping" regulations. About noon on 24th April a large number of the employes "struck," and were practically locked out pending submission. Agitation was carried on during the following few days. A committee of the Civil Commissioner, the Inspector of Searchers, myself and others, was convened, and on the 28th the Civil Commissioner telegraphed for troops, closed all canteens, and all fire-arms and ammunition were removed from the gunshops to the safe custody of the police.

At noon on the 29th a body of strikers some 300 strong, with an attendant mob of Cape boys and Kaffirs, numbering 1,000 to 1,500, marched from Du Toit's Pan and Bultfontein, where they had compelled stoppage of all work, to the De Beer's Mine, where, by threats of damage to person and property, they arrested all mining operations. Flushed with success they rushed on to the Kimberley Mine, and assembled on the south side about the Central and French Companies' works. The Central and French Diamond



Mining Companies were, however, determined to resist the hectoring of the rioters, and were well prepared to receive them. A body of special constables and a small force of police were stationed about the works for the protection of the water gear, which was kept always running to prevent the mine from being flooded with water, and a barricade of overturned trucks had been constructed, not so much for the purposes of protection of the gear and machinery, as with the view of defining a *rubicon*, the forcing of which by the rioters would render extreme measures unavoidable, and necessary for the safety of the companies' property and its defenders.

Here the rioters insisted on the water gear being stopped, and upon absolute refusal of their demand they charged the position, with the intention of stopping the water gear, threatening the lives of all who opposed them, and in defiance of repeated warnings given that they would be fired upon. As they broke through the barricade of trucks arranged for the protection of the machinery, they were fired upon, which fire they returned, and six of the rioters were killed or mortally wounded, and six others and two special constables wounded, not fatally. This determined attitude on the part of authority caused the malcontents to retreat, and the riot from that moment was quelled.

It is stated some 300 white men were dismissed from their former employment, and wages to the amount of over £50,000 were absolutely lost to workers in the mines during these fourteen days of idleness.

By the 7th of May work was generally resumed and in full swing at all the mines.

*Explosion of Dynamite Magazines.*—On 10th January a terrific explosion of gunpowder and dynamite, stored in some of the magazines, wrecked most of these buildings in the Magazine Park, situated at the south-east corner of De Beer's mining area. A full and careful record of this occurrence, framed by the then Assistant Inspector of Machinery, is published in a Special Report for the year 1884 [A. 2—'84]; but a few extracts therefrom will be acceptable in this place:—

*Extract from Report, 1884.*

"The explosion occurred at the magazines lying in the extreme south-east corner of the De Beer's mining area. These were situated in a long straggling group, running north and south at average intervals of 50 to 100 feet from one another, almost exactly two miles eastward from the Kimberley Mine, one mile eastward from the De Beer's Mine, and  $1\frac{3}{4}$  miles north of the Du Toit's Pan Mine.

"The nearest dwelling-houses were three-quarters of a mile to the south-west of the late site of these magazines. The nearest building was the corrugated iron enclosure of the Victoria Diamond Mining Company, used as a wood-sawing yard, where a few Kaffirs were at work; but the mass of houses of Kimberley was screened by the *débris* heaps and practically continuous mounds of old tailings which separate the De Beer's Mine from the late magazine site, and running to an average height of about 30 feet."

\* \* \* \* \*

"The magazines in which the explosives, &c., were stored were 16 in number, but of these 1, 2, and 16 were empty. These storehouses were simply huts, constructed of light wooden framing, covered with thin corrugated iron sheeting, and fitted at one end with an ordinary sized door of similar material. Some of the houses had a 9-inch lining of sun-dried bricks, and these are numbered 3, 4, 7, 10, 12, 13, and 15 on Plan No. 2 attached. Those houses numbered 7 and 10 were also virtually double stores, divided by a brick partition, and having separate entrances.

"The houses were unprovided with shelves of any kind, and the boxes of dynamite, &c., were simply laid on the earth floor and built one on the top of the other."

\* \* \* \* \*



"The explosion consisted of two distinct shocks, separated by an interval of a few seconds, as far as I could judge, and it occurred at 3.20 p.m. on the afternoon of 10th January. The maximum heat registered during the day in the shade was 91°, but at the time of the explosion the quietest of southerly breezes tempered the heat somewhat.

"Writing at the time in my brick-built office in the Government buildings (1½ miles distant), the first crash sounded in its clearness and enormity as though the house was falling in upon me, but the second report—which far exceeded the first one in loudness—left no doubt whatever in my mind but that the long-seen danger of the prevailing loose system of storing dynamite, &c., or of storing a variety of explosives together in the one magazine, viz., dynamite with blasting powder, and sporting cartridges, and detonators, and fuses, &c., or the equally reckless handling often seen of all and every kind of explosive in mining operations here had at last been verified by disaster.

"I arrived at the ground ten minutes afterwards with the Inspector of Mines, and found that destruction of the magazines had been complete. Twelve storehouses had been completely cleared away, while four (numbered 10, 12, 13 and 15) were partly standing, but completely ruined. I learn from two reliable and independent witnesses that previous to the explosion they saw flames and smoke rising up from the northerly end of the site of the magazines, and that the first report occurred about a minute after the fires were first seen. Immediately after the explosion an immense pear-shaped column of smoke (see sketch No. 3 annexed) rose into the sky, expanding slowly for a time at its top corners, and when it got into view over the roofs of Kimberley houses it could not have been less than 1,200 feet diameter. It was clearly visible at Newlands, and at Boshof, respectively 35 and 31 miles distant.

\* \* \* \* \*

"For fully half-an-hour after the explosion the bullets of rifle cartridges were flying about intermittently in all directions, and at the spots where the stores marked 3 and 4 (Plan No. 2) had been, fires were blazing. In the case of No. 4 paraffin was the stimulant, and in that of No. 3 I noticed a quantity of potentite quietly burning or melting away.

\* \* \* \* \*

Enclosed in a circle of about 500 feet radius, and approximately concentric with the body of the magazines, the ground was thickly strewn with all sizes possible of broken up and distorted pieces of corrugated sheet iron, lately forming the shells of the storehouses; also thousands of whole and damaged sporting cartridges, charred bits of wood, deformed tin cases, lately holding paraffin oil, &c., were lying about in dire confusion. A space comparatively clear of *débris* existed around, and especially to southward of houses numbered 6 and 7. The only magazines not completely ruined were those numbered 12 and 13, the latter marked C in photograph numbered 5 annexed. These houses were completely minus roofs, but the brick-work of their sides (especially to the northward), and the corrugated iron sheeting, also, was partly left standing. All the stores in these magazines, as well as in magazines 10 and 15, were saved, with the slight exceptions noted in the table, and they were removed immediately after the explosion to places of safety, under proper supervision. The sites of the houses numbered 3, 5, 6, 7 and 11, were marked by deep excavations or craters having been formed in the earth by the violence of the explosion of their contents; that numbered 5, in which no less than 629 50-lb. boxes of dynamite had been stored (over 14 tons weight), being considerably the largest.

"The foundation ground here was basined out at its deepest part to about 5 feet 6 inches, and the average diameter of the crater (virtually elliptical in shape) was about 40 feet. Annexed to this report (No. 4) is a sectional sketch of its appearance.

"About 100 yards to the northward of the site of the late magazines,



and separated from each other by an interval of about 40 yards, were found the dead bodies of two natives, with their faces on the ground, and their bodies in such positions as could leave no doubt that they were killed whilst running away from the immediate scene of the disaster.

"A third Kaffir, who was working at the time of the explosion in the wood-yard of the Victoria Diamond Mining Company (200 yards distant) was taken to hospital, suffering from the effects of being violently struck in the back by some object thrown by the explosion, and he died in the hospital the following day."

\* \* \* \* \*

"No further injury to person, as far as I can learn, was done by the explosion. A gang of labourers working on the neighbouring floors, about 500 yards westward, with picks and shovels, were thrown momentarily to the ground, but they were not hurt."

\* \* \* \* \*

"The nearest erection of any kind to the magazines was the wood-yard of the Victoria Diamond Mining Company, 200 yards westwards; this was fairly destroyed."

\* \* \* \* \*

"The only further damage done to property was the breaking of windows within a radius limited about  $1\frac{3}{4}$  miles from the scene of the explosion, and the bursting open of doors and shutters, by the fastenings giving way, within a radius of  $1\frac{1}{4}$  miles; and for a distance up to about  $2\frac{1}{2}$  miles radius the falling of hanging lamps from ceilings and the breakage of room ornaments in falling from their shelves."

\* \* \* \* \*

"The approximate total amount and variety of explosives, &c., in storage, and divided into quantities lost by and saved from explosion, is summarised as follows, from my previously given detailed statement:—

	Dynamite.	Potentite, &c.	Detonators, &c.	Powder, &c.	Rifles, Cart-ridges, &c.	Paraffin Oil.
Lost	30 tons	3 tons	841 cases	$7\frac{1}{2}$ tons	317,000	75 cases
Saved	13 „	$\frac{1}{3}$ „	211 „	6 „	23,000	
Total amount in storage on Jan. 10	43 tons	$3\frac{1}{3}$ tons	1,052 cases	$13\frac{1}{2}$ tons	340,000	75 cases

"The value represented by the above loss of explosives, &c., at existing Kimberley market prices, including the complete dispersement into small fragments of the storehouse, I calculate to amount to a sum of not less than £17,000 (seventeen thousand pounds sterling).

\* \* \* \* \*

"It appears that the two Kaffirs who were killed were in the employ of the merchant owning magazine No. 4, in which only paraffin (75 cases) was stored. They had been sent down to help in off-loading a waggon of dynamite, expected to arrive at 2 p.m. on that day, but which, even at the time of the explosion—3.20 p.m.—had not passed through the customs at Du Toit's Pan.



"These Kaffirs had no means of entering the store, *i.e.*, they had no key to building, and it can be fairly presumed that on this hot afternoon, whilst waiting for the waggon, they sat in the shade of one of the magazines and smoked (as every Kaffir does). These unfortunate men, in my opinion, must be held accountable for the disaster. They were the only men seen by white overseers, working on the neighbouring floors, to go to the magazines, and, personally, I do not think that the theory of spontaneous combustion can in this case be seriously discussed to account for the explosion.

"I have myself seen, and in fact it is notorious, that certain of the houses—those without a brick lining—had on occasions been tampered with, *i.e.*, an iron sheet removed or loosened, simply by the aid of a screw-driver, and dynamite had been extracted; also that the doors of the houses, and even the sides, were in many instances far from tight-fitting, intervals of an inch or more space frequently existing; also that loose powder from broken bags or casks has been noticed by independent witnesses lying on the floors in certain houses, and presumably some may also in the same way have been lost during removal to or from the store to waggons, and have been lying on the ground outside the door. It has also been stated that the ground at or near a certain store has been found soaked with paraffin oil.

"Taking these facts into consideration, I think it a fair argument to suppose that a lighted match thrown away by one of these Kaffirs, who were most probably smoking, will have ignited something inflammable, or, on the other hand—though it seems to be only remotely likely—the firing of a store may have been a wilful act on their part.

"Smoke and flame were distinctly seen by the bystanders three-quarters of a mile away for some time before the first explosion occurred, and, after some seconds' interval, came the second tremendous report. My opinion is that the initial fire took place at either No. 3 or No. 7 store, but probably in magazine No. 7; that the two tons of powder stored here exploded, and made the first report, and that the immense second report was due to the dynamite stored in the several magazines exploding simultaneously. A space of ground practically concentric with these former dynamite stores, and comparatively clear of the *débris* of the buildings shattered by the explosion, appears to me to point to the fact that no one of these magazines exploded *after* another. How the *separate* houses containing dynamite were exploded is a question that, with my limited knowledge of explosives, I cannot enquire deeply into. Professor Abel has distinctly laid down that detonation is transmitted from one mass of an explosive to others through intervening air-spaces, and though it may be argued that these intervals in the case under notice are excessive, at the same time it must be remembered that the dynamite was stored in immense quantities; thus, in separate houses (No. 5) 14 tons, (No. 6) 7 tons, (No. 7)  $9\frac{1}{2}$  tons, and were exploded.

"Magazines Nos. 5 and 6 were separated from No. 7 by intervals of about 80 feet. I am inclined to think, however, that at any rate the dynamite in the exploded magazine No. 11, about 230 feet distant from No. 7 (where I believe the initial explosion took place) was exploded by a bullet or bullets discharged from this No. 7 magazine (where over 60,000 cartridges were stored) and all of which were dispersed far and wide. I am led to this belief by my observations of the features of the ruins of the houses in which the dynamite was saved, and I should add that it has been incontestably proved that the passing of a bullet into a box of dynamite must explode it. Here, on the side exposed to the exploded magazines, I found the still standing iron sheeting of the brick-lined houses, Nos. 12 and 13, completely riddled with holes, and a large number of these are incontestably clean bullet holes; in the soft brick walls underneath are the corresponding marks where the bullets impinged and formed dents about half-inch deep. Taking this fact of the dynamite being exploded in stores Nos. 12 and 13 with the fact of the total destruction of the dynamite in the approximately equally



distanced store No. 11 (which was not brick-lined), I arrive at the conclusion that the brick-lining saved the former houses, and that the agents in the destruction at any rate of this magazine were rifle bullets.

"Our previous knowledge of the intensely violent but very local damaging effects of an explosion of dynamite is strictly corroborated by the results of the disaster under notice. Although the immense quantity of over 30 tons of dynamite alone exploded *en masse*, we find that men working at a distance of 500 yards from the scene of the explosion, and without the slightest screen of any kind, were unhurt, and at the same time the extreme limit of the shock was felt at distances not covered by a radius of 20 miles.

"At the same time, we find the corrugated sheets of iron forming the shells of the magazines shattered into the veriest fragments down to the size of a shilling, and the displacement, too, of large quantities of foundation, soil and rock (but confined to the actual sites of the several magazines) testifying to its local intensity.

"The enormous pressure of the air at the immediate scene of the explosion is testified to by the effect it has had on the tin boxes containing rifle and revolver cartridges. The sides of the boxes are each and all bulged in in waving lines to the contour of the cartridges, compressing them together into a compact mass, and the bullets in many cases are driven down flush into their brass cases."

That so little damage was done to property in the town may be due partly to the extreme lightness of our atmosphere, and specially to the protection offered by huge mounds of debris, of tailings, and of reef, acting like a break-water between the township and the explosion.

*Small-pox.*—During this year the population of the Diamond Fields suffered from a visitation of Kaffir small-pox. Lazarettos were constructed, and all measures taken to thoroughly stamp out the disease, and after many months it gradually disappeared. The precise nature of this epidemic was not settled to general satisfaction; some medical men termed it "pemphigus," others genuine small-pox, and many persons, well acquainted with the country, termed it "Kaffir small-pox." There was a good deal of amusing party feeling, as most people supported their respective doctors, and society was divided for a time into medico-social cliques, which probably acted generally as a good counter-irritant to the fear of infection. The visitation, however, had one excellent result: the question of cleanliness throughout the community became a subject requiring the most earnest alteration, and the filthy Kaffir compounds of the mining companies were at last cleaned and made less unwholesome.

*Machinery.*—The hauling, washing, and pumping engines employed at the mines had by this time increased greatly in number and in power.

The excellence of gear was also much more carefully attended to, as the economy of first-class machinery and of keeping all plant in good order was beginning to be acknowledged. It will be of interest to give here an extract from the Report for 1884, by the Assistant Inspector of Machinery, showing the engines in use:—

\* \* \* \* \*

"*Machinery in Position.*—I have gone very carefully into the actual amount of mining plant *in situ* at the four mines at the end of 1884, and I believe the following Table No. 1 is absolutely reliable:—

"Table No. 1.—Return of Machinery in position at or about the Kimberley, De Beer's, Du Toit's Pan, and Bulfontein Mines at the end of 1884.



Date: December, 1884.	Kimberley Mine.	De Beer's Mine.	Du Toit's Pan Mine.	Bultfontein Mine.
Engines driving Hauling Gears:				
Number ... ..	37	24	51	32
Nominal Horse-power ...	593	339	670	384
Engines driving Washing Gears:				
Number ... ..	21	22	44	30
Nominal Horse-power ...	180	186	467	273
Pumping and other Engines:				
Number ... ..	23	15	27	10
Nominal Horse-power ...	242	114	129	57
Total Engines at each Mine:				
Number ... ..	81	61	122	72
Nominal Horse-power ...	1015	639	1266	714

"giving a total of 336 engines, equal in the aggregate to 3,634 nominal horse-power being in position at the Diamond Mines of Griqualand West.

"In addition to these, I should add that five boilers with their engines or pumps, &c., and quite lately in working order, are buried under reef in the Kimberley Mine."

\* \* \* \* \*

About the latter end of the year Sir Charles Warren's expedition was organised for Bechuanaland. His camp of instruction was situated at "The Bend," on the Vaal River, and a large number of his troops were recruited in the Kimberley district.

1885.—*Depth*.—The depth reached in Kimberley Mine in the open workings was 400 feet at the east end, and in underground workings 500 feet for workings, and 600 feet by a prospecting shaft. In De Beer's the greatest depth in open working was 360 feet, and by underground mining 460 feet. In Du Toit's Pan a prospecting shaft had reached 500 feet; the depth of the open working is not given. No depth is returned for Bultfontein Mine for this year.

*Main Reef*.—From July till November a large area of marginal reef, at the south-west of Kimberley Mine, steadily subsided, and in December suddenly sunk about 60 feet, wrecking an inside mine shaft at the west end. Shortly afterwards the old fallen reef from the slip of November, 1883, moved further southwards, stopped one shaft, and damaged two others; all these shafts were within the mine.

During August other two inside mine shafts, at the north-east of the mine, were destroyed by lateral movement of the fallen reef.

In De Beer's Mine the marginal reef began to give serious trouble. In March an extensive fall—after a period of the usual warning symptoms—took place from the eastern side, variously estimated at from 100,000 to 150,000 loads of 16 cubic feet, and covered a large area of the open workings below. About the same time the high "yellow" ground (unpayable) at the west end slipped down into the lower workings in the "blue," moving across the mine till it met and overlapped the broken reef which had just fallen from the eastern side. The quantity of this fallen "yellow" was estimated at 300,000 loads, but operations for its removal were so promptly initiated and so energetically carried on day and night, that by the 7th October following the "blue" ground claims were again clear and in full work. The fallen reef, however, was allowed to remain, and underground mining was adopted in the properties covered by it.

The floating reef had still further been reduced, and a considerable



surface of payable ground had been thereby added to profitable working places in "the open."

In Du Toit's Pan the main reef had not yet commenced to seriously interfere with work in the "open." Large masses of floating reef had, however, been removed.

Serious interference was caused by the state of the floating reef, which is very extensive in this mine, but the difficulties of dealing with it, owing to the position and obstructive policy of the owners of the soil, prevented the suffering claim-holders from taking proper steps for prevention of interruption through the slips and falls of the floating reef.

*Mining.*—Open mining in the Kimberley Mine was practically desisted from, and underground methods were adopted by all the working claim-holders. Four systems or methods were adopted, but they were all empirical.

They are shortly described in my Report for 1885 [G. 40—86], as follows:—

\* \* \* \* \*

*Extract.*

"These may be described roughly as follows, the winding shaft being a main feature common to all:—

"(1.) From a main tunnel connected with the shaft, drives are made at certain distances, and as these drives recede from the main tunnel they are opened out laterally and overhead, as the 'blue' is excavated to such dimensions as the manager thinks he dare go in safety, or rather without great danger. The dimensions in this system are approximately—main tunnel 6 feet wide by 7 to 8 feet high; side openings to the working chambers, or stalls, about the same, increasing in the chambers to about 18 feet wide by 20 to 25 feet high.

"(2.) Passes or down-casts are made in convenient positions from one level to the next level below, where they end in small tunnels connected with a main tunnel leading to the shaft bottom. At the bottom of each pass is a box with shutter, whereat the trucks may be filled with the broken 'blue' as it is shot down the passes. At the top of each pass the 'blue' is excavated all round funnel-wise and shot down. The opening, or chamber, resulting from this style of working is from 15 to 20 feet wide, and sometimes as high as 50 feet. When it is deemed that all the blue ground has been removed which can be excavated without great danger, the shaft-pillar is lowered by open working, and the walls and roofs of the workings are taken away on the 'open' system. I am not aware how it is intended to continue after the depth has been reached at and beyond which 'open' working locally will be impossible.

"(3.) A series of tunnels at a given depth are driven up to the boundary at right angles from a main tunnel, and along the boundary a working tunnel or gallery is made about 8 feet high; the blue-ground is excavated backwards, or retiring from the boundary towards the shaft, and the space left by excavation of the 'blue' is filled or packed up with fallen reef by hand labour, so that by the time one working is finished back to the shaft (or near it) there is a layer of broken reef occupying the position from which the 'blue' was taken. Upon completion of one such working, a fresh series of tunnels are driven over the top of the packed reef to the boundary, and the operation repeated, and so on upwards, till it is considered that the minimum thickness of roof, or 'middlings,' between the space excavated from and packed with reef and the overlying fallen reef has been reached. The shaft is then sunk to a further depth for repetition of the process.

"The fallen reef to be packed into the vacant working is either sent down in trucks, or fed down a shoot or pass from above, and filled into trucks below ground, and so conveyed to the spot where it is required.

"The theory is that the packed reef will support the blue-ground above  
[G 11.—'90.]



it, and that even if the blue-ground does settle *en masse* it will still be adequately supported by the packed reef upon which it rests, and that tunnels may be safely driven through and working carried on in it. This I am very doubtful of, because (a) the reef packed in by hand cannot fully occupy the space from which the solid blue-ground has been taken, and therefore cannot form an unyielding support to the blue-ground above it; and (b) if blue-ground even *en masse* settles only a few inches, the integrity or cohesion of the whole body is to a great extent destroyed, and therefore tunnels and workings could not be carried on through or in it in safety. Tunnel driving and ordinary work of excavation are attended with sufficient risks even when in unmoved solid blue-ground.

"(4) From the main tunnel connected with the winding shaft, tunnels are driven up to the boundary, and along the boundary a working tunnel or gallery is made, somewhat similar to the last foregoing (3) system, but instead of retiring horizontally with a face of 8 feet high towards the shaft, the working gallery is carried vertically upwards, and as the blue-ground is worked out and removed, fallen reef is allowed to run down and fill in by its own action below the feet of the miners. In this system the reef is tapped above, and, under control, is allowed to fill in below as required. Upon one vertical section being finished to the top, another, parallel to it and adjoining the reef which has occupied the space excavated, is commenced at the bottom and carried upwards, the reef coming in all along one side of the gallery as required. The width of the gallery on this system is about 10 to 12 feet, and the roof about 6 feet high; the floor of reef is always following upwards. Shoots or passes are cut in the blue-ground on the solid side of the gallery as it rises, down which the loosened blue-ground is shot to the tunnels below.

"In all of the systems there are the necessary provisions for access, escape, ventilation, and drainage, more or less efficient.

"They may be all deemed experimental, as the conditions under which underground mining in diamondiferous rock must be conducted are novel and quite peculiar. Mining engineers do not seem to be determined as to what system should be adopted for underground mining in these mines.

"The winding-shafts in connection with the above-mentioned systems have been sunk in claim-ground, as being cheaper and sooner available than shafts outside the mine, with tunnels constructed through the hard rock to claim-ground, but these shafts in claim-ground can be only of very temporary character."

\* \* \* \* \*

The ("Atkins") shaft on the north outside was deepened, and at 500 feet level a tunnel driven through the "Hard Rock," into the blue, about 700 feet long altogether. The last shot connecting both headings was fired by electricity, from a chamber in the mine-heading, by my daughter on 30th November. This was the first accomplishment of a proper system of winning the diamondiferous rock or ground by means of an underground tunnel connecting with a shaft outside of the mine, and the permanency of the industry was so to say thereby stamped as beyond speculation. The shaft on the south side was being deepened for a like purpose; but the position of this shaft is not convenient for access to the depositing floors, which are all to the northwards of the mine.

In the De Beer's Mine underground mining had greatly developed, the method generally adopted being that described above as number 1 in vogue in the Kimberley Mine. Open working was carried on to a greater extent than underground working, as there was a large area of the mine still uncovered by fallen reef.

The sinking of the large circular shaft commenced upon the north side and already mentioned was suspended, and in lieu thereof an incline shaft was opened on the western side and carried down at an angle of  $56^{\circ}$  with the horizon into the "blue" to a vertical depth of 500 feet; the surface opening



of that shaft was about 150 feet west from the claim margin, and it passed in its descent just over the edge of the Hard Rock. Specially designed skips carried on four-wheeled carriages running on rails were provided, and delivery boxes erected at the surface, into which these skips tipped their contents. On the east another incline shaft was sunk on an angle of  $35^{\circ}$  into the blue; the surface opening was about 500 feet east from the claim margin, and descended to a vertical depth of 420 feet, cutting through the edge of the Hard Rock. Then within the mine there were one incline shaft and four vertical shafts, all in connection with underground operations, more or less advanced.

In the Du Toit's Pan and Bultfontein Mines aerial gears—tub and sling-gear—were still the system of haulage, and, with the exception of a prospecting shaft in Du Toit's Pan, there was no underground mining in either.

The Searching System, this year handed over to the control of the Mining Boards and in operation at all four mines, had given no increase of satisfaction to those for whose benefit it was designed. The Mining Managers held the system as carried out to be inadequate, and a useless expense. The Chief of the Detective Department, in reply to a series of questions on the subject submitted by me, was of opinion (1) that after the first two months the effect of the searching system (as prosecuted by the Mining Boards) upon theft of diamonds was nil; (2) that it could not be enforced so thoroughly as to prevent 90 per centum of the illicit traffic without an unjustifiable increase in cost of administration; (3) that companies should themselves do the searching, and the duty of effectually and properly carrying it out should rest with them; (4) that a universal compound system, and a careful and efficient system of guarding the floors would be a better means for the prevention of theft and for the recovery of stolen diamonds.

In Kimberley Mine the compound system on strict principles was introduced, with the most gratifying results, which may be shortly summarised as follows:—(1) A full supply of labour on Mondays, whereas under the former *regime* the whole of Monday and generally the forenoon of the Tuesday were lost to claimholders, owing to the Kaffir labourer being drunk and incapable from indulgence in "Cape smoke," procured at the "Kaffir canteens" on the Saturday previous; (2) searching is more efficiently carried out, and without the objections observable under the Mining Board's searching system; (3) the Kaffirs, after experience of the compound system, liked it, and being enabled to save money instead of spending it to the benefit of low canteen-keepers, soon improved in *physique* and *morale*; (4) the advantages to the township in the suppression of noisy drinking shops, and in the freedom from brawling, fighting, disgraceful and often dangerous conduct of drunken Kaffirs in the streets on Saturdays and Sundays, which went on regularly throughout the year.

At De Beer's Mine, on the floors, a convict compound was built on the plan of a prison, and constituted a "gaol" by the Government, the whole being under orthodox prison discipline.

At the Bultfontein Mine two companies had adopted the "compound system."

*Pit Gas.*—In De Beer's Mine, on the 22nd July, an explosion of fire-damp took place in the underground workings in "blue ground" at south-east of the mine, at a depth of about 350 feet from the surface. The gas issued from a dyke of shale, which was being cut through, in the "heading." Another instance of the presence of pit gas in this mine occurred in September, at a similar depth, also in underground workings in the "blue," but close to the hard rock on the east side of the mine; in this case the gas was lit and put out repeatedly, as it issued from a fissure in the rock, till the "blower" became exhausted. Pit gas has been found in the black shale enclosing the Kimberley Mine upon three occasions, but never anywhere in purely "blue ground."

*Railway.*—A most important event, the opening of the railway from



Orange River to Kimberley, was celebrated on the 28th November. The benefits conferred on this industrial centre by direct rail communication with the coast cannot be over-estimated.

1886.—*Depth.*—In Kimberley Mine, in the open workings, the depth reached by end of 1886 was 450 feet at the east end of the mine, and by shaft sinking 700 feet. In De Beer's the deepest point in open workings was 400 feet, and in underground mining 654 feet. In Bultfontein Mine the greatest depth is returned at 390 feet in open workings.

*Main Reef.*—There were falls of main reef in April, October, and November, in the Kimberley Mine, and large quantities of fallen reef were removed from open workings in the south-eastern portion of the mine, the only part where open-work mining was adhered to.

The Main Reef at De Beer's Mine had now become thoroughly burdensome, and many large falls are reported as having occurred during the year. In November and December the falls of main reef stopped all open working, with the exception of one gear.

In Du Toit's Pan Mine the first serious fall of main reef in this mine happened in March, by which 8 white men and 10 Kaffirs were killed. Probably the want of experience in such occurrences, through the hitherto immunity from reef falls in this mine, prevented those in charge of operations and employés from giving due attention to the admonitory cracks and other potent signs which main reef invariably gives for some time, weeks or months, before any extensive subsidence or fall. The mass of reef that fell on this occasion was calculated as 200,000 loads of 16 cubic feet.

In Bultfontein Mine some claim-holders began to tackle the standing main reef, in order to prevent if possible any future stoppage of work in claim ground through falls of reef.

*Mining.*—In Kimberley Mine, at a small portion of the claims at the east of the mine, aerial gears were still employed for raising "blue," and a few were used for hauling fallen reef about the middle of the open; but underground mining had practically displaced open work generally in the mine; still no common plan had been adopted by the different holders, nor were the systems all the same. As the holders did not yet submit to the adoption of a general plan, the obstacles, difficulties, and dangers of underground operations were needlessly continued, and expenses of work were not reduced, as they might and should have been.

In De Beer's Mine there were two incline shafts in operation, in which skips with flanged wheels ran on rails, delivering into "boxes" at the surface. In the east of the claim-ground a vertical shaft had been sunk from the open workings; in this an aerial gear was adapted; the tub-carriages, after leaving the aerial tramway wires, from the surface edge to the head of the shaft, engaged with wooden guides in the vertical shaft, the hauling wire passing over a pulley at the change of direction. To the north of the mine, nearly 600 feet from the open edge, a new shaft 20 feet by 6 feet, close timbered down to the Hard Rock, was being sunk, to be the main winding shaft for the whole mine.

Aerial gears still "ruled the roast" as the means of haulage in the Du Toit's Pan and Bultfontein Mines.

*Searching System.*—The searching system was still in vogue, but constant complaints were made by diggers of its inefficiency and expense. It was acknowledged and called a farce, but was nevertheless carried on.

*Suffocation by Dynamite Fumes.*—The only occurrence recorded as worthy of note in the Reports for this year was a painful case of suffocation, through the combustion of a quantity of dynamite in a tunnel in the underground works in De Beer's Mine, by which 13 Kaffir miners lost their lives. The accident is reported as follows:—

*Extract.*

"During the blasting time at sunset, 27 men, who were about to com-



mence work for the night, were in a tunnel as a place of shelter, in which no work was then in progress, but which was used for storing the daily requirements of dynamite for the neighbouring works. Some loose cartridges of dynamite were lying on the floor, which unaccountably became ignited and burnt out, filling the tunnel with noxious vapours, which had the effect of producing congestion of the lungs of the men in the tunnel.

"The blasting being over, the men, with one or two exceptions, proceeded to their work, and continued working throughout the night until relieved at sunrise next morning, when grave symptoms manifested themselves, and medical aid was at once obtained; but, notwithstanding eight of them succumbed that morning, during the succeeding night and morning five others died, making a total of 13."

*Gold Fields.*—The gold fever broke out, and the rush to the Transvaal Gold Fields began during the latter half of 1886. The building of Johannesburg, the capital of those fields, was commenced during September.

1887.—*Depth.*—The greatest depth in the Kimberley Mine by the end of 1887 was 740 feet, of course in the underground workings, and similarly in the De Beer's Mine 700 feet. In Du Toit's Pan Mine the greatest depth attained was 400 feet, and in Bultfontein 460, in both cases open workings.

*Main Reef.*—During January between 30,000 and 40,000 loads of main reef fell from the south-east part of Kimberley Mine, and during September, on the north side, a mass of loose reef, 50,000 to 60,000 loads, slipped from over the hard rock into claim ground, and on the south east a large fall of main reef took place in the same month. The removal of standing and fallen reef lying above the level of the hard rock was recommenced in September by means of the ordinary aerial gears.

In De Beer's Mine reef removal operations were entirely desisted from during the latter half of the year. (No reef standing or fallen has since been taken out. Enormous areas of the main reef have from time to time subsided minewards, and the fallen reef, fallen high yellow ground, and remaining floating reef now completely cover the old open claim workings.)

An extensive fall of main reef occurred in August in Du Toit's Pan Mine, on the north east side, and a subsidence of high blue at the east. There were several minor falls of main reef during the year.

The marginal reef in Bultfontein Mine also began to give trouble. In February a heavy fall took place on the south side, and in June a great mass of high yellow slipped from the north side into claim workings. One of the claim-holding companies in this mine carried on most energetic operations for the removal of the upper and threatening portion of the main reef standing over their claims, in order so to lighten it that their payable claims should not in the future be stopped working through infalls of the reef. But the reef work in this, as in the other mines, was begun too late, and prosecuted by the one or two instead of by all claimholders, and the result desired—permanent freedom of claim workings from stoppage by falls of reef—has not been achieved.

*Mining.*—A few claims in the east of the Kimberley Mine were worked on the open and underground methods; the remaining portion of the mine wholly on underground systems.

It was intended by the management of the mine at the time to develop a system of mining combining the leading features of open working and underground mining, a description of which is included as an extract in my Annual Report for this year [G. 28—88] page 6 *et seq.* (Now, as in the De Beer's Mine, underground mining is the only method followed).

The shaft on south side Kimberley Mine had reached 541 feet in depth, when further operations were suspended. The old mining board shaft on the north side, hereinbefore mentioned, section on 1881, was dismantled and abandoned.

In February an incline shaft  $12\frac{1}{2}$  by 6 feet was commenced on the



north-east side; the surface opening (not far from the position of the old mining board shaft) is about 600 feet from a vertical falling on the upper edge of the "hard rock." It is sunk for 730 lineal feet at a horizon angle of  $32^\circ$ , entering 180 feet into the hard rock, then descending vertically to the 800 feet level. Another incline shaft was constructed at the west end,  $15\frac{3}{4}$  feet by 6 feet. It descended for 504 feet lineal at a horizon angle of  $36^\circ 33'$ , and for 414 feet at an angle of  $52^\circ 40'$ . Through movement of the high west end ground and main reef, this shaft has since crushed in and been abandoned.

In the De Beer's Mine there was one powerful aerial gear in operation. The standing wires were anchored at the 380 feet level, at the bottom of a sloping tunnel, in the standing high ground at the west end of the open mine, and spanned the mine to the margin of the east side, a distance of 1,000 feet.

This gear conveyed ground from the underground workings on the 500 feet level, through the sloping tunnel, and over the open mine to a delivery box on the east side. It was disused in the following year. An incline shaft, termed No. 1, already described at the west side, was also in full use all the year; that incline shaft on the east side referred to in section on 1885, was disused; but another new incline shaft, 19 feet 6 inches by 5 feet 9 inches, was commenced in June on the west side, a short distance from No. 1 above, and carried down on a similar angle ( $56^\circ$ ) to (in 1888) the 700 feet level.

The rock shaft on the north side, constructed with one pump compartment  $5\frac{1}{2}$  feet by 6 feet and three cage compartments 4 feet by 6 feet each, attained a depth of 822 feet, to serve the 800 feet level.

No open work in claim ground was carried on, and by the end of this year the whole of the "blue" ground—from underground mining—was raised by means of No. 1 incline shaft and the aerial gear above described.

In Du Toit's Pan and Bultfontein mines work was wholly in open claims. No serious attempt at underground mining had yet been made, as it was generally considered that the yield from these poorer mines would not pay the cost of underground systems.

*Mechanical Haulage.*—In May a system of mechanical haulage was put in operation between the Kimberley mine and the floors, and has given great satisfaction in reduction of expenses for tramping, certainty of work, and especially in minimising theft of diamonds by the drivers of traction cattle under the former custom. Many of these drivers undoubtedly afforded facilities as agents in conveying stolen diamonds from the thieves to the illicit buyers. This mechanical haulage consisted of a heavy chain cable carried at suitable intervals upon the full and empty trucks, running on a double railway between the mine and the nearest side of the depositing floors.

The engine is of locomotive-boiler type, and is of 25 horse-power; the rate of travel is about a mile in 15 minutes, depending, however, on the exigencies of work. The average number of trucks running on each line is 70, and the average number of loaded trucks sent to the floors per day is 3,000, which can be increased to 8,000 per similar period.

*Temperature.*—The temperature was taken during the month of February—summer—below and above, with following results.

On Sunday, when workings were all idle, it was in a tunnel on the 575 feet level Kimberley Mine  $84^\circ$ , and on the surface in shade also  $84^\circ$ ; on a week day in full work in the same tunnel  $78^\circ$ , and on surface  $81^\circ$ . In the De Beer's Mine, on a Sunday, all idle, in a tunnel on the 600 feet level the temperature was  $76^\circ$ , and surface  $82^\circ$ ; and on a week day in full work  $77\frac{1}{2}^\circ$  and  $80\frac{1}{2}^\circ$  respectively. The De Beer's Mine was the better ventilated underground of the two mines.

*Amalgamation.*—During the year 1887 many amalgamations of claim properties were carried out. In the Kimberley Mine the following were absorbed by the Kimberley Central Diamond Mining Company, viz., Stand-



ard, Kimberley United, North East, North Block, and De Beer's late French Companies.

In the De Beer's Mine, the De Beer's Mining Company absorbed the Gem, Oriental, Victoria, and Schwab's Gully Companies, by which amalgamations the whole of De Beer's Mine became the property of the first-named.

In Du Toit's Pan the Griqualand West Diamond Mining Company amalgamated the late Hercules, late Kimberley, Schoonraad's, Ward's, Mylchreest's, and Orion Companies' claims. In Bultfontein, French and D'Esterre, Le Diamant, Barker, Wells and Brodie, Adamant, and others were amalgamated under the title of the Consolidated Company, Bultfontein.

*Searching System.*—In the De Beer's Mine the searching system, as carried on under Mining Board supervision, had with that body been abolished, and the company properly assumed its own searching duties.

In the other mines the system was still under the Mining Board government.

*Electric Signalling.*—Electric bells had now been generally adopted for signalling requirements in underground mining, and also in the open workings.

1888.—*Depths.*—The greatest depth in the Kimberley Mine reached by the end of the year was 825 feet, of course in underground shafting; all work in "blue" in the open claims had been given up.

In De Beer's a depth of 805 feet in the underground workings had been attained.

*Main Reef.*—Up to 7th November operations for removal of the fallen reef from the open workings had been in full swing in the Kimberley Mine, but on that date an extensive subsidence of high ground and reef took place from the western portion of the mine, sliding eastwards, and generally destroying the underground workings down to the 600 feet level. Since then no reef removal operations have been undertaken.

In De Beer's the reef was not interfered nor dealt with. It fell in, subsided; and followed the broken "blue," in the old open workings, as the progress of underground mining removed and weakened the supporting "blue" below.

Extensive falls of main reef occurred in the Du Toit's Pan Mine; one on the south-west side in February, considered the heaviest in that mine so far; since that, another on the north-west, one of main and floating reef on the east, another of reef and "yellow" on the same side, and a large fall of reef on the south side, besides several smaller falls.

In the Bultfontein Mine an extensive fall of main reef took place on the east side in the early part of the year, followed by several heavy falls about the same locality, extending round to the north, and consisting of "blue" and floating shale on the north east of the mine. During the year a very large area of marginal reef had been removed by the principal companies, with the view of securing immunity from reef falls for some time to come.

*Mining.*—The underground system of mining had finally superseded open working in the Kimberley mine, and by the end of the year there were three main levels (*i.e.*, levels on which the ground is conveyed direct to a shaft) in use: the 525 feet level connecting with the old shaft ("Atkins") on the north side, the 625 with the new west and the north-east incline shafts, and the 725 similarly connected. All these shafts were winding shafts, delivering direct on the surface of the mine.

The "hard rock" in the Kimberley mine changes at a depth of 710 feet from amygdaloid to quartzite (the thickness of which has not yet been ascertained).

The winding shafts in De Beer's Mine comprised the No. 1 incline and No. 2 incline completed in March. The output by those shafts reached a daily (24 hours) total of 8,500 loads of 16 cubic feet. The rock shaft on the north side had been sunk to a depth of 841 feet, and a tunnel at the 800 feet level



was being driven to the mine. The incline shaft on the east of the mine was being adapted for purposes of ingress and egress and for ventilation.

Another shaft, as a main escape way, was constructed during the latter half of the year, in the high ground at the west end of the mine.

The large aerial gear mentioned in the section on the previous year had been removed, on completion of No. 2 incline shaft, so concluding the use of aerial gears in this mine.

The hard rock in this mine alters from amygdaloid to quartzite at 685 feet depth in the rock shaft, and has so continued as far as the shaft is at present sunk.

In the Du Toit's Pan and Bultfontein mines only aerial gears were in use for winding purposes.

*Compound and Searching Systems.*—Guarded compounds were fully adopted in the Kimberley and De Beer's Mines for all Kaffir labour, and the searching was carried out in these mines by the companies. Kaffir labourers are contracted for terms of two months and upwards, most of them re-engaging on expiry of service.

During the period of contract they have to live entirely in the compounds, but may leave whenever they choose. Wages are paid wholly in cash; food and clothing can be purchased within the compound barracks. Medical attendance, &c., and wood and water are supplied to them free. No alcoholic liquors are allowed, and consequently the daily supply of labour is steady, and the Kaffirs are enabled to save money, as very many of them do, to take back with them to their countries. Under the former open compound custom almost the whole of the Kaffir labourers' wages went into the pockets of Kaffir canteen keepers, and the outcry by that fraternity against the close or guarded compound system was loud and vicious. Many efforts were made by them and their sympathisers to defeat the introduction of the system, and attempts to mislead the Kaffirs and to excite their opposition were numerous, but happily in vain. The Kaffirs have found out the much superior advantages to themselves derivable from submission to this close compound system, and by preference engage for such service instead of under the open compound conditions.

In Du Toit's Pan and Bultfontein Mines the closed compound system was not universally adopted, but had been introduced by some of the more powerful and wealthy companies. In these two mines the searching remained in charge of the respective mining boards.

*Disaster by Fire.*—A most deplorable loss of life was caused through the destruction by fire of the No. 1 incline shaft in De Beer's Mine on 11th July. By some undiscovered means an underground timbered shaft, between the 500 and 700 levels, took fire, and the flames quickly travelled through a connecting tunnel—close timbered—to the No. 1 incline shaft, up which, being an up-cast, the fire tore rapidly, and within about 20 minutes that shaft was useless and practically wrecked. No. 2 incline, which had been disabled for winding purposes in the morning, through a skip running off the rails, but still available for escape, was also an up-cast, and dense volumes of smoke from the burning timber soon filled this shaft to suffocation. An old disused shaft at the eastern end of the mine, and the old tunnel into the open mine at the 380 level, where the aerial gear formerly worked, were the only sources of fresh air. According to returns furnished after the disaster, 24 white men and 178 Kaffirs were killed, mostly through being asphyxiated by the smoke. There were at the time of the outbreak of fire 67 white men and 625 Kaffirs at work underground.

*Mechanical Haulage.*—A system of mechanical haulage was constructed at De Beer's Mine; the traction agent is a wire rope. From the mine the length of the line (double) with a branch line is three and a quarter miles.

*Electric Light.*—The extensive depositing floors attached to the De



Beer's Mine are provided with electric lamps, and all the permanent ways underground in this mine are illuminated with incandescent lights.

*Village for Employés.*—About a couple of miles from De Beer's Mine the building of a village of employés' houses was commenced; it is situated upon land belonging to the company. Married and single quarters, mess-houses, reading and recreation-rooms, gardens and cricket-grounds will be provided. I believe it is intended that no alcoholic liquors, not even table beer, is to be allowed in the village; such an absolute prohibition seems rather grandmotherly and unnecessary.

*Amalgamation.*—During October the newly-created company, the De Beer's Consolidated Mine, Limited, acquired the whole of the property of the De Beer's Mining Company.

In Bultfontein Mine the Consolidated Company absorbed additional claim property.

*Nationalities of Miners.*—As an item of interest, I ascertained the percentage of nationalities of the white employés for this year with the following result :—

Kimberley Mine, British, 55; colonial, 43; other, 2 per cent.

De Beer's Mine, British, 65; colonial, 30; other, 5 per cent.

*Debris Washing.*—Owing to the effects of amalgamation of claim properties in raising the price of diamonds and reducing employment of labour, prospecting for new mines, re-testing formerly discovered ones, and washing of the debris—old sortings and tailings—were extensively carried on during the year. The old debris, from 20 to 30 feet deep, lying about the margin of the Kimberley and De Beer's Mines, paid good profits to washers; but that lying on abandoned floors, so far as tried, does not seem to have been profitable.

The outlay required for entering upon washing debris not being great, many unemployed diggers gave the speculation a trial; the whole cost of a second-hand engine and washing gear with a few old trucks and rails, and the purchase of the necessary draught cattle, would be from £300 to £1,000 for the initial effort.

*Hospital.*—This most important institution has been an inestimable boon to the mining community, and a few particulars concerning it will doubtless be appreciated in this place. For the following information upon the subject I am indebted to the courteous sister in charge.

"A small hospital was built by Governor Southey in 1874, and burnt down before it was used. It was rebuilt early in 1875, and is still in use, and known as Southey Ward.

It contained, at first, 14 beds, a tiny room for the married couple who managed it, storeroom, and cupboard for medicine. It had only a mud floor. It now contains beds for 13 native women, 2 native children, and for 3 C.D.A. European women, bathroom, scullery, and convalescent room. Two nurses attend to it by day, and one devotes the greater part of her time to it by night.

Sir Owen Lanyon added a bell tent for natives in 1876; about 6 laid on the ground in a blanket. He also built a small house, which he intended for a private nursing institution, but he wished private patients who could not be nursed in their own homes, or who had no homes, to be taken in there.

Every corner of this building was at once filled with patients, paying at first 7s. 6d. a day, and, although it now with various additions contains 74 beds, they have been and are generally crowded with patients.

This part now contains 14 free beds for men, 6 for women, and 6 were freed by the town for this year for children, at a cost of £300. The other rooms are charged for at rates varying from 5s. to £1 per diem, according to the diet, stimulant, &c., ordered. There are 48 beds for paying patients.

There are 220 beds for native patients male. These are divided into 100 for convalescents, 55 for accidents, 50 for medical cases, and 15 for contagious



diseases (now in course of construction). Whenever a native is able to get up and walk about, he is sent from his bed to the convalescent ward, where he is compounded, and attended to by the nurses, but where he lives and eats according to native customs.

Private patients may, if they like, engage their own medical attendant, but any one can have the resident staff free of charge. The native and and free beds are divided amongst the visiting staff.

The hospital is mainly supported from three sources:—a Government grant, see Blue-books; patient's fees, which come to several thousands per annum; and the native tax of 1s. a month on each pass. This does not pay their expenses. 1s. 3d. a month would not be much felt by them, and would enable the Hospital Board to work freely. At present the Board undertakes to provide for them at a lower rate than any benefit society in England would attempt to do.

The last two years the town has subscribed nobly. Last year there was a single donation of a thousand guineas.

The average number of patients in 1876 was about 16, in 1882 it was 98, in 1888 it was 255·02, and 3,780 patients were admitted. There is, besides, a large out-patient department. This year, 1889, there has again been a slight increase in the numbers.

The staff in 1876 consisted of a resident surgeon, dispenser, and a married couple, with their daughter as cook. In 1889 a staff of 40 workers is provided by St. Michael's Sisterhood, at a cost £2,000 per annum. These consist of matron, home sister, two in the work room, housekeeper, and 35 nurses. There is also a considerable staff of private nurses, who are sent for from all parts of South Africa. Besides these, there are two house surgeons, secretary, storeman, dispenser, overseer, 19 native ward servants or scrubbers, cooks, housemaids, &c.

All kinds of appliances are needed in the hospital. £500 is required to provide decent bedsteads. The supply of hot water to the wards is at the rate of about one gallon to 40 beds, and the difficulty with poultices, fomentations, baths, &c., is untold. There are no proper bathrooms or lavatories in the whole building. The lighting for safety, coolness, cleanliness, and pure air should be electric; instead, there are nearly 100 paraffin lamps."

1889. The changes during the ten past years, as far as the mining industry in Griqualand West is concerned, have been so great that a person formerly a resident here, who had not been on the Diamond Fields during that period, would hardly recognise the industry as followed in the Kimberley and De Beer's Mines, apart from the big holes in the ground surface. The margins of these mines are devoid of aerial gears (there are two at Kimberley Mine, but they are used in connection with underground workings), and there is no work of any kind going on in the open mines. Above ground these mines—compared with the state of things in 1881—look deserted and miserable, a condition, however, amply refuted below ground.

#### KIMBERLEY MINE.

*Kimberley Mine.*—The underground workings in the Kimberley Mine have not gained greatly in depth, but on the 725, 755, and 785 levels have been enormously developed. On the eastern side of the mine the diamondiferous rock was found to expand for some distance on the 710 level, but whether this additional area below ground will continue or increase with depth, or be found to be merely a lateral intrusion of the lava into the pipe rock at this locality, can be determined only as the works deepen, or by means of prospecting operations.

During January a new vertical shaft was commenced within the open mine on the north side. From the surface of the hard rock there the fallen reef was removed, the shaft was sunk through the rock, and has now reached the 845' level. The sectional area is 12 by 10½ ft.; divisions are provided for two skip-ways and one double ladder-way. The winding engine is



situated upon the land surface on the north side, the hauling wires being carried over pulleys, suitably placed, from the winding drum over the shaft-head pulleys to the skips. The "blue," on being delivered by this shaft at top of hard rock, will be conveyed to the land surface in tubs of two aerial gears, delivering into the usual boxes on the margin of the open mine.

Another vertical shaft was commenced during March, about 1,100 feet north from the edge of the open mine, and has now reached a depth of 566 feet, having passed through 35 feet of debris and surface, 54 feet of yellow shale, and 249 feet of black shale. It is  $20\frac{1}{2}$  feet by 6 feet in cross section within timbers, and will be provided with two skip-ways, one cage-way, and one division for the pump.

*Compounds.*—There is nothing new to record about the compound system in this mine, excepting the enlargement of the building and enclosure.

A covered way has been completed from the opening of the north-east shaft, by which employes descend to work, and from the new rock shaft within the mine (above described) by which they ascend from the workings to the compound, so as to prevent any communication between outsiders and mining employes going to or returning from work.

In connection with this covered way there is a novel feature worth mentioning. The covered way, by which the employes from the mine rock shaft march to the compound, reaches only from the compound to the edge of the mine opening; there is consequently a distance of some 450 feet between that end of the covered way and the head of the rock shaft within the mine. This space has been spanned with a suspension bridge, constructed of six 5-inch standing wires securely anchored above on the land level and below at the shaft mouth platform. Upon these six wires a wooden deck is built, provided with suitable steps, and with a hand-rail on either side. The swaying motion of the bridge is to some extent controlled by means of guys attached at the centre of the bridge and carried over pulleys below to very heavy counter loads.

*Plan and Section.*—A plan and section of the Kimberley mine are appended to this report, upon the latter of which I have sketched the profile depths of workings 1871—74 and 1878 in so far as photographs of the periods enable me to do so; the Section 1883 is from the plan attached to my report for that year. The underground workings since that date, and also the discovered position of the enclosing hard rock pipe, have been added by the surveyor of the De Beer's Consolidated Mines, Limited, by the courtesy of the General Manager.

*Hard Rock.*—The lower workings from the 710 down to the 845 level are still enclosed within quartzite.

*System of Working.*—Mining is carried on entirely on the underground method. Two aerial gears are employed, but are, as already stated, merely complementary to the new rock shaft sunk within the mine. This mine could yet be worked as an open mine; and I still venture the opinion that it might be advisable to remove the fallen reef and resume exploitation of the "blue" upon the open system, drawing the ground through the tunnels below and outside hauling shafts.

*Assessment.*—No assessment of the claim property has been made for this year, as it is held by one proprietary.

*Depth.*—The greatest depth attained by the end of this year was 845 feet.

*Diamonds.*—According to the return of the Board for Protection of Mining Interests the amount of diamonds won during the year, was 816,135 carats, of a declared value of £1,132,490 7s. 11 $\frac{3}{4}$ d.

*Water.*—The inflow of mine water was about 280,000 gallons daily. The quantity of water used daily for all mining purposes is calculated at from 30 to 40 gallons per load of ground finally treated. This estimate applies equally to other mines where similar blue ground is manipulated in like manner.



*Labour.*—The annual returns of labour employed in and about the mine and on the floors are :—Above ground, white 185, coloured 800 ; below ground, white 152, coloured 1,500.

*Wages.*—Wages ranged from £4 to £7 per week to white men, and 32s. per week to Kaffirs, with lodging, wood, water, and medical attendance.

*Nationalities.*—The nationalities of white employes were :—English 55, Scotch 18, Irish 9, Colonial 15, European 2, other 1 per cent.

*Cattle.*—90 horses and mules were, on an average, daily at work.

*Locomotives.*—Seven locomotive engines of 10-horse-power, 18 inch gauge, are in use on the floors.

*Mechanical Haulage.*—The mechanical haulage as erected in 1887 is still in use, and working admirably.

*Fuel.*—The cost of English coal is returned at £9 per ton, delivered. No wood is used.

*Surface Opening.*—The surface opening of the Kimberley Mine is returned at 31 acres.

*Accidents.*—There have been 38 accidents during 1889, from which 63 persons suffered. Of these 15 were killed on the spot or fatally injured.

*Summary of Accidents, Kimberley Mine.*

Nature of Accident.	Number of Persons.	
	White.	Coloured.
Blasting ... ..	3	9
Fall of Ground ... ..	4	14
Other ... ..	11	22
	—	—
	18	45
Results of Accidents.		
Died ... ..	2	13
Recovered ... ..	16	32
	—	—
	18	45

DE BEER'S MINE.

1889.—*De Beer's Mine.*—The only modification in the working of this mine is the enormous development of the underground systems. There are two main levels, one at 700 feet connecting direct with the No. 2 incline on the west, and the other at 800 feet communicating direct with the new rock shaft (vertical), sunk about 550 feet to the north of the mine, by means of a fine tunnel eleven feet wide by eight feet driven through the hard rock (quartzite) for 416 feet, and 8 feet by 8 feet for 276 feet through "blue."

The head-gear, winding engine, and steam boilers at the rock shaft have been erected, a full description of which will be found in the report on machinery by my Assistant, Captain Quentrall.

The old incline shaft ("Oriental") at the east end has been connected with the 500 feet, and thence by ladderways with the 600 feet levels.

*The System of Working.*—Is entirely underground, and in this mine open working on the old method is out of the question.

*Hard Rock.*—The enclosing pipe at 840 feet is still quartzite, and I am not aware that any prospecting has been done with the view of ascertaining the character of the rock at a greater depth.

*Working Levels.*—There are seven working levels and the two main levels (already noted at 700 and 800 feet respectively).

*Depth.*—The greatest depth reached in diamondiferous ground by the end of the year was 800 feet.

*Diamonds.*—947,195 carats, of a declared value of £1,312,871 19s. 0¼d. are returned by the Board for Protection of Mining Interests as the realized yield from De Beer's Mine for this year.

*Water.*—The mine water averaged 200,000 gallons daily ; after being pumped from the mine it runs to a reservoir formed by a dam built by the



company on their Kenilworth property, wherein it is conserved for mining purposes.

*Labour.*—The daily labour is returned by the company as follows:—Above ground, 350 white, 700 coloured; below ground, 200 white, 1,460 coloured.

*Wages.*—The weekly wages to white men were from £4 to £7; and to Kaffirs 29s. 6d., carrying quarters, medical attendance, wood, and water.

*Nationalities.*—The white miners and employés working in and about the De Beer's Mine and floors were, approximately, of the following nationalities:—English 50, Scotch 20, Irish 8, Colonial 12, European 4, American 1, other 5 per cent.

*Cattle.*—365 horses and mules, and no oxen, were daily employed on the lines and floors.

*Locomotives.*—No locomotives have yet been used at this mine.

*Mechanical Haulage.*—As in last year the mechanical haulage system has been regularly in use, and fulfilling requirements.

*Electric Light.*—This method of lighting is extensively employed on the floors and in all standing tunnels in the mine.

*Surface Area.*—The area of the surface opening is returned by the De Beer's Consolidated Company at 18·68 acres.

*Fuel.*—The cost of fuel is returned at £9 per ton of English coal, delivered. Hardly any wood used.

*Accidents.*—There have been 83 accidents of sufficient importance to record, from which 83 persons suffered; of these 36 were killed on the spot or fatally injured.

Besides the above, there were many cases of bruises and of lacerations reported to this office, but of so trifling a nature that to include them in the table of mine accidents would be inadvisable. Kaffir miners, as a rule, desist from work if a finger be scratched sufficiently to bleed, and remain idle until the scratch is healed.

#### *Summary of Accidents, De Beer's Mine.*

Nature of Accident.	Number of Persons.	
	White.	Coloured.
Blasting ... ..	4	12
Fall of Ground ... ..	1	7
Other ... ..	4	55
	—	—
	9	74
Results of Accidents.		
Died ... ..	5	31
Recovered ... ..	4	43
	—	—
	9	74

#### DU TOIT'S PAN MINE.

1889.—*Du Toit's Pan.*—Open working was for nearly the whole year general throughout the Du Toit's Pan Mine. Amalgamation of properties, however, brought about the disuse of many gears toward the end of the past twelve-month. Underground mining was ventured in earnest for the first time in this mine at the north-east end, where one outside shaft has been sunk to a depth of 259 feet (sundry others were sunk, but only for prospecting purposes), and a tunnel was driven from the open workings at 275 feet from the surface, into the "blue" beyond the present surveyed area of the mine, for the purpose of testing the extent of certain additional area freshly leased as claim ground.

*Amalgamation.*—The Griqualand West Diamond Mining Company with its amalgamations was absorbed by the De Beer's Consolidated Mines, which has also acquired the property of the Compagnie Generale, of the Sultan, United and Anglo-African.



*Depth.*—The depth attained in open workings is not much greater than that of last year.

*Claims and Assessment.*—According to the Register, the number of claims was in November, 1,497; the assessment for the year (framed in November, 1888), was £1,290,560.

*Labour.*—The number of persons employed in and about the mine and on the floors, by returns supplied, were:—Above ground, 238 white, 1,590 coloured; below ground, 59 white, 262 coloured.

*Wages.*—To white men the wages ranged from £2 to £6 1s. 10d. per week; and to Kaffirs 18s., with lodging in compounds.

The Board for Protection of Mining Interests returns the diamonds won from Du Toit's Pan Mine at 450,336 $\frac{1}{4}$  carats, of a declared total value of £897,586 2s.

*Accidents.*—There have been 116 accidents during the year, from which 129 persons suffered. Of these 30 were killed on the spot or fatally injured.

*Summary of Accidents, Du Toit's Pan Mine.*

Nature of Accident.	Number of Persons.	
	White.	Coloured.
Blasting ... ..	1	4
Fall of Ground ... ..	6	52
Other ... ..	14	52
	—	—
	21	108
	—	—
Results of Accidents.		
Died ... ..	6	24
Recovered ... ..	15	84
	—	—
	21	108
	—	—

**BULTFONTEIN MINE.**

1889.—*Bultfontein Mine.*—By the end of this year there were only 4 aerial gears at work in the mine. As in the Du Toit's Pan Mine, amalgamation of claim properties had caused the cessation of working of nearly all the aerial gears. The bottom of the open mine was and is almost entirely covered with fallen reef and ground, which from late falls has gradually moved across the mine. On the north-east of the present surveyed area of claim ground, about 500 new claims have been taken out, and winding shafts for working the property on underground methods are being sunk with dispatch. The depths attained by these shafts are, one to 440 feet, one to 294 feet.

A few falls of high ground have taken place during the year, but none of great importance.

*Amalgamation.*—The De Beer's Consolidated Mines, Limited, acquired the Bultfontein Mining Company's, Bultfontein Consolidated Company's, the South African Company's, and Spes Bona properties.

*Depth.*—The depth, owing to the open workings having been practically stopped by the extensive falls of the previous year, has not increased.

*Claims and Assessment.*—934 claims appeared on the register as in November, but that number does not include the new 500 claims above-mentioned. The assessment for 1889 (framed in November, 1888) was £581,232.

*Labour.*—During the greater part of the year, that is, previous to the extensive amalgamations, the number of persons employed is returned as follows:—Above ground, 66 white, 308 coloured; below ground, 22 white, 210 coloured. Returns incomplete.

*Wages.*—As in Du Toit's Pan.

*Diamonds.*—The diamonds realized from Bultfontein Mine in 1889 are



given by the Board for Protection of Mining Interests at 541,300 $\frac{3}{4}$  carats, of a declared value of £746,817 4s.

*Accidents.*—There have been 67 accidents during the year, from which 94 persons suffered. Of these 24 were killed on the spot or fatally injured.

*Summary of Accidents, Bultfontein Mine.*

Nature of Accident.	Number of Persons.	
	White.	Coloured.
Blasting ... ..	2	7
Fall of Ground ... ..	3	56
Other ... ..	2	24
	—	—
	7	87
<i>Results of Accidents.</i>		
Died ... ..	0	24
Recovered ... ..	7	63
	—	—
	7	87

ST. AUGUSTINE'S MINE.

1889.—*St. Augustine's Mine.*—Work in this mine has not been prosecuted since June.

The depth attained in shaft sinking was 450 feet by end of year.

*Labour.*—The labour is returned as follows:—Above ground, 10 white, 29 coloured; below ground, 12 white, 21 coloured.

*Wages.*—Wages ranged from £4 10s. to £7 per week to white men, and £1 10s. per week to Kaffirs, with lodgings.

*Fuel.*—The cost of firewood is returned at £2 15s. per load of 2,000 lbs., and of African coal at £5 15s. per ton.

*Diamonds.*—Diamonds found weighed 152 $\frac{1}{2}$  carats, and were valued at £253 10s.

*Accidents.*—Three accidents occurred during 1889, from which three persons suffered, one of whom was killed.

OTTO'S MINE.

1889.—*Otto's Mine.*—The main winding shaft in the mine has reached a depth of 800 feet.

*Water.*—Water hauled is stated at 8,000 gallons per 12 hours.

*Labour.*—The labour is returned as follows:—Above ground, 9 white, 42 coloured; below ground, 5 white, 32 coloured.

*Wages.*—Wages range from £4 to £6 10s. per week to white men, and 22s. 6d. per week to Kaffirs.

*Nationalities.*—The nationalities of white employes were:—English 50, Scotch 20, Irish 10, Colonial 10, European 10 per cent.

*Fuel.*—The cost of firewood is returned at £2 10s. per load of 2,000 lbs., and of African coal at £6 per ton.

*Diamonds.*—The diamonds won during 1889, as per return compiled by the Board for the Protection of Mining Interests, amount to 85 $\frac{1}{4}$  carats, of a declared value of £127 17s. 6d.

*Accidents.*—There have been two accidents during 1889, from which two persons suffered.

TAYLOR'S MINE.

*Taylor's Kopje.*—This mine is closed down.

GENERAL.

*Population.*—No census has been taken by the Borough Council of the



population of the Diamond Fields, but in the Cape of Good Hope Blue Book for 1880 it is stated that in 1877 the population was as follows:—

Divisions.	Europeans.			All others.			Grand Total.
	Males.	Females.	Total.	Males.	Females.	Total.	
Kimberley Division	5,687	3,623	9,310	9,383	2,017	11,400	20,710
Barkly do.	764	523	1,287	6,808	6,699	13,507	14,794
Hay do.	362	291	653	2,513	2,409	4,922	5,575
Herbert do.	571	553	1,124	1,606	1,468	3,074	4,198
Griqualand West	7,384	4,990	12,374	20,360	12,543	32,903	45,277

Area of the territory is 17,800 square miles.

*Trade.*—Since the completion of the colonial railway system to these fields, great numbers of visitors to our mining centre, and of travellers to and from the interior, have come to and passed through Kimberley. The continuation of the railway to Bechuanaland, commenced November of this year, will doubtless cause considerable contraction of the mercantile business in this place, and compel merchants to push on their distributive stores to the terminus of the railroad as that is advanced further to the northward; but, with our important and valuable diamond mines and the developing gold-fields in the district, Kimberley must continue to hold a position of the first importance as a mining centre.

*Diamonds Exported.*—The total weight of diamonds lawfully realized from the Griqualand West Mines since the opening of the diamond mining industry in 1869 has been computed at 10 tons. To this amount should be added 25 per centum, as a moderate estimate of the illicitly procured stones, to give the approximate quantity of  $12\frac{1}{2}$  tons as the total yield from these mines for the period 1869 to 1889, inclusive.

*Heavy Deposit.*—It may be of interest to mention here what are the characteristic minerals composing the “heavy deposit” of the diamondiferous rocks in these mines. They are (1) diamonds, (2) olivine, (3) orthoclase, (4) ilmenite, locally and erroneously termed “carbon;” (5) garnets, usually called “rubies” by the diggers; and (6) iron pyrites.

The outside shafts sunk in connection with diamond mining at the Kimberley and De Beer’s Mines have passed through the following rocks of varying thickness:—

Surface red soil from a few inches to some feet,  
 Surface lime           “           “           several feet,  
 Yellow shale           “           30 feet to 60 feet,  
 Black           “           180 feet to 250 feet,  
 Amygdaloid           “           380 feet to 450 feet,

and have entered some 150 feet into the underlying quartzite.

In some parts of the enclosing rocks tufaceous basalt is found below the surface lime, from 30 to 50 feet thick.

The manager of the De Beer’s Consolidated Mines, Limited, has kindly furnished me with a geological section of the rocks outside the Kimberley and De Beer’s Mines, which sections are attached to this report.

A description of the fire-extinguishing appliances adopted in the underground workings is given by my Assistant, Captain Quentrall, in his report for the year.

W. C. C. ERSKINE,  
 Inspector of Mines.

Kimberley, 13th February, 1890.



CLAIMS.—The number of claims registered as on the last day of each year, and the annual assessments for rating purposes in the four principal Mines were as follows :—

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889
Kimberley { Claims Assessment £	..	420	..	..	365·6	345·6	320	324·2	289·5	..
De Beer's { Claims Assessment £	..	..	..	..	3,047,037 19 9	No Assessment	1,452,273 19 0	1,364,130	1,358,770	1,353,760
Du Toit's Pan { Claims Assessment £	..	610	..	..	594	591	583	469	578 <sup>3</sup> / <sub>4</sub>	..
	..	..	..	..	..	934,737 3 1	933,960	1,965,830	No Assessment	No Assessment
	..	1453	..	1501	1501	1430	1411	1499	1497	1651
Bultfontein { Claims Assessment £	..	..	..	..	2,343,414	1,282,691	1,087,892	1,133,215	1,291,410	1,290,560
	..	1003	..	1037	983	822	828	930	934	1037
	..	..	..	..	660,085	682,266	415,845	492,275	574,900	581,232

NOTE.—The above assessments are inserted under the years for which they were severally made, but each assessment roll was framed in the latter end of the previous year.



DIAMONDS YIELDED.—The annual yield and declared value of Diamonds from ground washed and other sources by each Mine (Kimberley, De Beer's, Du Toit's Pan, and Bultfontein), as shown by the Returns of the Detective Department and Association for the Protection of Mining Interests, were :—

	1881	1882	1883	1884	1885	1886	1887	1888	1889	Totals.
Kimberley Mine, carats ..	900,000*	380,955 $\frac{1}{2}$	947,817 $\frac{3}{4}$	642,438	523,774 $\frac{1}{2}$	889,864	1,333,832 $\frac{1}{2}$	1,332,809	816,135	7,767,625 $\frac{5}{8}$
Declared Value £ ..	1,575,000	456,420	846,705	634,332	458,858 4	3883,503 4 9	1,410,207	1,270,873 5 0	1,132,490 7 11 $\frac{3}{4}$	8,668,389 1 11 $\frac{3}{4}$
De Beer's Mine, carats ..	300,000	140,513 $\frac{1}{2}$	426,728 $\frac{1}{2}$	497,596 $\frac{1}{4}$	566,233 $\frac{3}{4}$	795,895	1,014,048	1,003,406 $\frac{1}{2}$	947,195	5,691,616 $\frac{1}{2}$
Declared Value £ ..	600,000	157,220	435,762	579,608	500,134 10 11	754,735 17 6	1,022,878	935,444 6 10	1,312,871 19 0 $\frac{1}{2}$	6,298,654 13 5 $\frac{1}{4}$
Du Toit's Pan Mine, carats ..	..	190,948 $\frac{1}{8}$	435,658 $\frac{1}{2}$	498,550 $\frac{1}{2}$	560,912 $\frac{1}{2}$	700,302 $\frac{1}{2}$	696,576 $\frac{1}{2}$	569,013 $\frac{1}{2}$	450,336 $\frac{1}{2}$	4,102,297 $\frac{1}{2}$
Declared Value £ ..	..	313,040	573,772	760,218	690,360 19 9	977,204 0 11	987,283	758,463 15 4	4897,586 2 0	5,957,927 18 0
Bultfontein Mine, carats ..	..	143,936 $\frac{1}{2}$	502,029 $\frac{3}{4}$	566,201 $\frac{3}{4}$	636,340 $\frac{1}{4}$	661,339 $\frac{1}{2}$	602,246	659,887 $\frac{1}{2}$	541,300 $\frac{3}{4}$	4,313,281 $\frac{3}{4}$
Declared Value £ ..	..	192,530	503,227	588,465	579,326 1 9	645,806 13 2	612,962	642,762 19 1	1746,817 4 0	4,511,896 18 0
Annual Total—carats ..	..	856,353 $\frac{3}{8}$	2,312,234 $\frac{1}{8}$	2,204,786 $\frac{1}{2}$	2,287,261	3,047,400 $\frac{1}{2}$	3,646,702 $\frac{3}{4}$	3,565,116 $\frac{1}{2}$	2,754,967	21,874,821 $\frac{3}{4}$
Annual Declared Value £	..	1,119,210	2,359,466	2,562,623	2,228,679 16 8	3,261,249 16 4	4,033,330	3,607,544 6 3	4,089,765 13 0	25,436,868 11 5

\* Estimated for 1881.

N.B.—The Diamond Trade Act came into operation 1st September, 1882.



The AVERAGE PRICE per Carat realized upon the Diamonds produced by each Mine.

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	Average.
Kimberley Mine ...	...	...	s. d. 23/11 $\frac{1}{2}$	s. d. 17/10 $\frac{1}{4}$	s. d. 19/9	s. d. 17/6 $\frac{1}{4}$	s. d. 19/10 $\frac{1}{2}$	s. d. 21/1 $\frac{1}{4}$	s. d. 19/0 $\frac{3}{4}$	s. d. 27/9 $\frac{1}{4}$	s. d. 20/10 $\frac{1}{4}$
De Beer's       " ...	..	...	22/4 $\frac{1}{2}$	20/5	23/3 $\frac{1}{2}$	17/8	19/5 $\frac{1}{2}$	20/2	18/1 $\frac{3}{4}$	27/6	21/1 $\frac{1}{2}$
Du Toit's Pan   " ...	...	...	32/9 $\frac{1}{2}$	26/4	30/5 $\frac{3}{4}$	24/7 $\frac{1}{4}$	27/11	28/4	26/7 $\frac{3}{4}$	29/10 $\frac{1}{4}$	28/4 $\frac{1}{2}$
Bultfontein     " ...	...	...	26/9	20/0 $\frac{1}{2}$	20/9 $\frac{1}{2}$	18/2 $\frac{1}{2}$	19/6 $\frac{1}{4}$	20/4 $\frac{1}{4}$	19/5 $\frac{3}{4}$	27/7	21/7
Annual Average ...	...	...	26/5 $\frac{1}{2}$	21/2	23/6 $\frac{3}{4}$	19/6	21/8 $\frac{1}{4}$	22/5 $\frac{3}{4}$	20/10	28/2	22/11 $\frac{3}{4}$



The Average Number of Employés, exclusive of Managers and Secretaries, white and colored, including Kaffirs, and weekly rate of wages were as below. N.B. Kaffirs (only) were supplied with lodging, wood, and water, in addition to their wages.

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889
Kimberley Mine	...	800	700	400	300	450	430	740	560	337
	...	3000	4000	2000	1500	1500	2000	2500	2000	2300
	Totals	3800	4700	2400	1800	1950	2430	3240	2560	2637
De Beer's Mine	...	300	300	200	250	320	200	500	480	550
	...	2000	2000	1260	1700	1700	2400	3000	2500	2160
	Totals	2300	2300	1460	1950	2020	2600	3500	2980	2710
Du Toit's Pan Mine	...	1000	...	320	400	770	590	420	380	297
	...	8000	...	2800	3300	4500	4030	3200	2500	1852
	Totals	9000	...	3120	3700	5270	4620	3620	2880	2149
Bultfontein Mine	...	1000	...	220	260	360	290	260	260	88
	...	4000	...	2300	2500	3600	2530	2600	2600	518
	Totals	5000	...	2520	2760	3960	2820	2860	2860	606



## The AVERAGE WEEKLY RATE of WAGES was:—

	1880		1881		1882		1883		1884		1885		1886		1887		1888		1889	
	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.
Kimberley Mine	...	...	...	...	7 10	0 0	8 0	0 0	7 0	0 0	6 0	0 0	...	...	5 10	0 0	...	...	6 5	0 0
	...	...	...	...	7 10	0 0	8 0	0 0	7 0	0 0	6 10	0 0	6 5	0 0	6 5	0 0	6 10	0 0	6 0	0 0
	...	...	5 0	0 0	5 0	0 0	5 0	0 0	4 10	0 0	4 5	0 0	5 18	0 0	4 0	0 0	5 0	0 0	4 10	0 0
	...	...	1 15	0 0	1 10	0 0	1 10	0 0	1 5	0 0	1 0	0 0	1 5	0 0	1 7	0 0	1 10	0 0	1 10	0 0
De Beer's Mine	...	...	...	...	8 0	0 0	8 0	0 0	7 0	0 0	5 18	0 0	6 0	0 0	6 0	0 0	7 0	0 0	6 5	0 0
	...	...	...	...	8 0	0 0	8 0	0 0	7 0	0 0	6 2	6 0	6 10	0 0	6 10	0 0	6 0	0 0	6 0	0 0
	...	...	...	...	4 12	6 0	4 10	0 0	4 10	0 0	3 15	0 0	5 12	0 0	4 15	0 0	5 0	0 0	5 0	0 0
	...	...	...	...	1 5	0 0	1 10	0 0	1 5	0 0	1 0	0 0	1 0	0 0	1 5	0 0	1 0	0 0	1 10	0 0
Du Toit's Pan Mine	...	...	...	...	8 0	0 0	6 10	0 0	6 0	0 0	6 0	0 0	5 18	0 0	6 0	0 0	6 0	0 0	6 1	10 0
	...	...	...	...	6 0	0 0	6 0	0 0	6 0	0 0	...	...	5 8	0 0	6 5	0 0	6 5	0 0	6 0	0 0
	...	...	5 0	0 0	5 0	0 0	4 10	0 0	4 0	0 0	4 0	0 0	4 6	0 0	4 5	0 0	4 0	0 0	4 5	2 0
	...	...	1 5	0 0	1 10	0 0	1 5	0 0	1 5	0 0	0 15	0 0	0 18	0 0	1 0	0 0	0 18	0 0	0 18	2 0
Bultfontein Mine	...	...	...	...	8 0	0 0	6 10	0 0	6 0	0 0	6 0	0 0	5 10	0 0	5 10	0 0	6 0	0 0	6 0	0 0
	...	...	...	...	6 0	0 0	6 0	0 0	6 0	0 0	...	...	6 5	0 0	6 0	0 0	6 5	0 0	7 0	0 0
	...	...	5 0	0 0	5 0	0 0	4 10	0 0	4 0	0 0	4 0	0 0	3 0	0 0	4 0	0 0	4 0	0 0	4 10	0 0
	...	...	1 5	0 0	1 10	0 0	1 5	0 0	1 5	0 0	0 15	0 0	0 19	0 0	1 0	0 0	0 18	0 0	0 18	0 0

\* Receive also a percentage on diamonds found in "picking."



The number of CATTLE daily at work is estimated at :—

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889
Kimberley Mine	Horses	400	420	...	180	{ 200 }	...	285	300	{ 90 }
	Mules	130	100	...	40		...	68	50	
	Oxen	70	100	...	30		...	...	...	
De Beer's Mine	Horses	230	{ 250 }	...	160	{ 300 }	...	466	231	{ 365 }
	Mules	35		...	54		...	...	47	
	Oxen	...		...	...		...	64	100	
Du Toit's Pan Mine	Horses	...	...	...	...	...	...	577	556	...
	Mules	...	...	...	...	...	...	263	254	...
	Oxen	...	...	...	...	...	...	68	64	...
Bultfontein Mine	Horses	...	...	...	...	...	...	428	50	...
	Mules	...	...	...	...	...	...	159	100	...
	Oxen	...	...	...	...	...	...	42	60	...



The number of Cases of Traffic in Illicit Diamond Buying tried, and the results, as returned by the Special Court.

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889
Trials ... ..	...	...	104	171	178	177	181	138	162	100
Convictions ... ..	...	...	80	117	108	113	127	86	125	75
Withdrawals and Acquittals	...	...	24	54	70	64	54	52	37	25



Number of Sufferers by Mining Accidents during the decade, according to Returns furnished to this Department, in—

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889
Kimberley Mine—										
Fatal ..	21	20	43	16	8	26	26	44	35	15
Recovered ..	29	50	55	44	36	41	86	78	72	48
Total ..	50	70	98	60	44	67	112	122	107	63
Fatal average per 1,000 employed	..	5.	9.	6.6	4.4	13.3	10.7	13.2	13.7	5.6
De Beer's Mine—										
Fatal ..	8	5	10	11	9	22	46	40	226*	36
Recovered ..	11	12	14	29	31	28	57	31	81	47
Total ..	19	17	24	40	40	50	103	71	307	83
Fatal average per 1,000 employed	..	2.17	4.3	7.5	4.6	1.9	17.7	11.4	Fire	13.2
Du Toit's Pan Mine—										
Fatal ..	..	..	8	3	14	10	44	26	22	30
Recovered ..	..	..	17	24	51	73	81	72	53	99
Total ..	..	..	25	27	65	83	125	98	75	129
Fatal average per 1,000 employed	..	..	..	1.	4.	1.9	1.	7.2	8.	13.9
Bultfontein Mine—										
Fatal ..	..	..	2	6	12	13	26	21	19	24
Recovered ..	..	..	13	22	37	39	44	27	42	70
Total ..	..	..	15	28	49	52	70	48	61	94
Fatal average per 1,000 employed	..	..	..	2.3	4.3	3.3	9.2	7.3	6.6	†

\* 202 killed in Disaster by Fire in July. † Only two Companies have sent in returns, the average fatality cannot therefore be computed for employes in Bultfontein Mine for 1889.



## ANNEXURE I TO REPORT I.

## MINING ENGINEER'S REPORT FOR 1889.

Owing to the amalgamations and changes that have recently taken place, I think I may confine my observations mainly to the De Beer's and Kimberley Mines, now being worked as the De Beer's Consolidated Mines, Limited.

The most important additions to the machinery set at work during the past year have been at the new vertical Rock Shaft at De Beer's, which is about 540 feet from the north side of the mine, and from which, at a depth of 800 feet, a level has been driven to the mine, draining it at that depth. At this shaft new pumping and winding engines, boilers, head gear, &c., of the most modern kind, have been erected, as will be seen from the following descriptions:—

*Pumping Engine.*—This is a compound jet condensing engine, made by Simpson & Co., of London. The high-pressure cylinder is 14" diameter, and the low pressure cylinder 22", with a stroke of 30".

Both high and low pressure cylinders are fitted with expansion valves, which work on the back of the ordinary side valve, and there is an auxiliary valve to supply high pressure steam to the low pressure cylinder when required.

This engine is capable of developing about 120 horse power.

The pinion is 1' 10", and the spur-wheel 10' 6"; giving a ratio of about 1 to 5.75.

The fly-wheel is about 5 tons.

The spur-wheel is fitted with bosses on the arms, providing for three lengths of pump stroke, viz., 6, 7, and 8 feet. At present the 6-feet stroke is used, conveyed by the sweep-rod direct to the shaft-bob.

It will be very interesting to ascertain the actual duty performed by this engine, and I hope this will shortly be done.

*Winding Engine.*—This is a direct acting compound horizontal engine, supplied by the Grange Iron Company, Limited, of Durham, England.

The cylinders are 24" diameter, with a stroke of 5 feet.

There are two winding drums 10' 6" diameter by 4' 4 $\frac{1}{4}$ " in width, fitted with grooved tread, to prevent friction on the rope. This arrangement is acting admirably.

There are powerful steam brakes attached, and also brakes that can be applied by means of foot-levers.

Lawrence & Daglish's patent automatic expansion gear is in use, and clutch-gear, for regulating the length of the rope, is connected to one of the drums. One of Tangye's compound high pressure engines, with 16" cylinders and 28" stroke, geared 3 to 1, and 6 feet drum, will be used for the purpose of lowering and raising men, sending down materials, &c.

*Boilers.*—Four new "Fairburn Beeley" boilers have been erected to supply steam to the pumping and winding engines in this part of the mine, and, as this type of boiler contains many points of interest, and has only recently been introduced, I append longitudinal and transverse sections, which have been kindly supplied by the General Manager of De Beer's, and which will give a good idea of its construction.

The boiler consists of two vessels, C and D, the lower of which contains, for about two-thirds of its length, a single tube, in which the fire grate is arranged, the remaining one-third being multitubular, thus increasing the heating surface. To facilitate the removal of this tube, when repairs are necessary, the front plate is bolted to the boiler, and small wheels are attached to the lower part of the tube, which run on rails fixed within the boiler.

One of the main features of this form of boiler is the great extent of heating surface exposed. It will be seen, by referring to the sections, that

[G 11—'90.]

G



the flues reach to about the middle of the the upper vessel, thus entirely enclosing the lower vessel, and nearly one half the upper.

The direction of the hot gases is indicated by the arrows.

The ordinary mountings are attached, and to obtain drier steam a dome, W, is provided.

The feed-pump employed is of the Cameron type, and a portion of the exhaust steam from the winding engine is passed through a water-heater to heat the feed water.

The working pressure is 120 lbs.

I believe experiments will shortly be made to determine the evaporative power of these boilers, which will be very instructive.

Substantial brick houses have been built for the boilers and winding engines, in which, as far as possible, the use of timber has been avoided. The roofs, doors, floors, window frames, &c., are all of iron, and every precaution has been taken to reduce the risk of fire to a minimum.

*Head-gear.*—A new wrought iron trellis work head-gear is erected on this shaft. The height from the ground level to the centre of the pulleys is 61 feet. The corners of the legs and stays are  $3\frac{1}{2}$ " angle iron,  $\frac{5}{8}$ " thick. The lattice bars are  $3\frac{1}{2}$ "  $\times$   $\frac{5}{8}$ ".

There are three 14-foot pulleys, cast iron rim and boss, with wrought iron spokes. Two of these 14-foot pulleys were cast whole by Fraser & Co., of Du Toit's Pan, and the other was sent out in halves from England.

Very convenient steps and hand-rail, leading to the pulley platform, are fixed on the right-hand back stay. The dumping level is 25 feet from the ground.

*New Rock Shaft, Pitwork, &c.*—The new vertical rock shaft is 20 feet by 6-feet, divided as follows:—Pump and ladderway compartment,  $5' 6" \times 6'$  with one cage and two skip compartments, each  $4' 4" \times 6'$  within timber.

There is a very good ladderway fixed in this shaft, securely fenced off from the winding compartments.

The pitwork, supplied by Harvey & Co., of Hayle, Cornwall, is of the ordinary Cornish type, and consists of three 9-inch plunger lifts, with 10-inch wood rods, and balance box at surface. The whole is working admirably. The quantity of water now being pumped is about 5,000 gallons per hour.

New  $3\frac{1}{2}$ " guide wires (Elliot's patent lock coil wire ropes) are about to be fixed in this shaft. Omerod's patent self-detaching hooks will be used, to prevent accident in case of over-winding; and a self-acting dumping arrangement will be adopted for tipping the skips. This shaft will shortly be the principal winding shaft of the mine, and when the plant is complete it is calculated that its hoisting capacity will be equal to 7,000 loads of 16 feet in 24 hours. The sinking of this shaft below the 800-foot level will be shortly resumed, and a substantial ground penthouse will be left, for the protection of the men employed in sinking.

*Kimberley Mine.*—The following are some of the alterations and additions that have been made to the machinery, &c., at Kimberley during the past year:—

The six boilers have been removed from the west-end shaft and erected at the standard shaft. These boilers are of the Lancashire type, working at a pressure of 100 lbs. From these boilers steam is now supplied to all the engines on the mine, with the exception of the engine driving the mechanical haulage.

The winding engine taken over from the French Company after the amalgamation has been thoroughly overhauled, and is now erected near the standard shaft, and drawing therefrom. Advantage has been taken of this alteration to place the present engine 40 feet farther from the shaft than the previous one, which is a great improvement. It is a compound direct-acting horizontal engine, of 80-horse power, with 20-inch cylinders, 6-foot stroke, and 10-foot drum. Three loads are now drawn in each skip, instead of 2 loads with the previous engine.



There have also been erected at the standard shaft, two of Davey, Paxman & Co.'s compound engines, of 16 horse power each. One of these engines is used for sending timber and materials down the shaft, and the other for sinking purposes.

Arrangements are now being made to fix a steam pump at the 845-foot level, at Harvey's shaft, which will force the water to the top of the shaft, where two boilers will be fixed, to supply steam to this pump, and also to another steam pump that will be erected at the top of the shaft, to force the water direct to the washing machines on the floors. Harvey's shaft is only about 30 feet north from the face of the hard rock in the open mine. From the top of this shaft to the 845 level is about 550 feet, the whole distance being in the hard rock, and it has been sunk during the past year.

Considerable improvements have been made on the Kimberley floors. Early in 1889 the new washing machinery was started, consisting of six 14-foot pans capable of washing 6,000 loads of blue in 24 hours. An automatic hydraulic feed arrangement was introduced, with several other improvements, forming altogether a very compact and efficient set of washing plant. The machinery is driven by one of Marshall's 16 horse power jet condensing engines.

Seven of Fowler's locomotive engines, of 10 horse power, were provided for use on the floors during 1889, and they are giving great satisfaction.

#### ELECTRIC LIGHTING.

*De Beer's Mine.*—During the past year the system of electric lighting has been much extended at surface, especially at the mechanical haulage and the floors. Including the telephones and bell circuits, there are now more than 35 miles of wire at the surface.

*Underground.*—In March, 1889, the installation of the underground system was carried out, with great ability and success, by the Company's electrician. Satisfactory insulation was the main difficulty to be overcome, and to effect this he introduced some special fittings, which are patented, and are manufactured by the United Electrical Engineering Company, of London.

For the lamps, the shade or reflector is made of porcelain, and is utilised, not only as the holder of the lamp, but also as a support for the necessary cut-outs and switches, and the wires passing to them. All are effectively insulated from the damp timber or walls to which this shade is attached, and the heat of the lamp preserves the insulation, in spite of the moisture which is constantly being condensed on the surface, as these fittings are fixed beneath the shade. A very simple modification of this plan is adopted for bracket lamps, magnetic cut-outs, single switches, and safety fuses, wherever they may be required; and the same principle has been efficiently adopted for the bells, signals, and semaphores.

The main cables from the dynamo are  $1\frac{1}{8}$ " diameter, consisting of wire insulated with india-rubber, which is protected by a covering of tarred hemp. The electric light is extended to the shafts and ladder-ways, and nearly all the timbered portions of the mine; in fact, there are over 2 miles of wire in the underground workings, with 85 Edison's swan glow lamps, having an illuminating power of 16-candles each, and burning at an electrical pressure of 100 volts. This is probably the most extensive underground system of electric lighting in the world, but as soon as the new dynamo arrives, which is now being made by Mather & Platt, it will be considerably extended.

The dynamo is driven by one of Fowler's compound condensing engines, of 10-horse power, working at a pressure of 130 lbs., and it is particularly worthy of note, that since it was started, 10 months ago, there has not been the slightest hitch, and, with the exception of a stoppage of an hour or two on Sundays, it has been running the whole of the time. This fact reflects great credit on Mather & Platt, the makers of the dynamo.

The great advantages of the electric light underground are very apparent.



It is more uniform and brilliant, and comparatively free from heat, and the air is not vitiated as it would be by the burning of a great number of candles. But, above all, the danger of fire is so much lessened by its use that this alone forms the strongest possible argument in favour of its general adoption, and I am glad to say that it will be introduced at Kimberley Mine during the present year.

#### ELECTRIC SIGNALS.

New ropes have recently been provided for the passenger cages at De Beer's, made by D. H. & G. Haggie, of Sunderland, and fitted with "Armstrong's Patent Electrical Signalling Apparatus." This consists of an insulated copper wire, passing through the centre of the winding rope, and connected with an electrical signal bell in the engine-house. A push button is placed at the top of the inside of each cage, communicating with the wire inside the rope, and by pressing this button the occupants of the cage can instantly communicate with the engine-man, whether the cage is in motion or at rest. This arrangement has been found to answer admirably, and its importance is self-evident.

#### TELEPHONES.

*De Beer's.*—In connection with the mechanical haulage and the mine there are 17 telephones, uniting the chief centres at surface and underground.

*Kimberley.*—Telephones are also being introduced here at surface and underground, and the number will be much increased in 1890.

#### APPLIANCES FOR EXTINGUISHING FIRES UNDERGROUND, &c.

Arrangements are now nearly completed, both at De Beer's and Kimberley Mines, for carrying into effect one of the new rules contained in the recently revised "Rules and Regulations for the Working of Diamond Mines."

As this is a new idea, and is intended to guard against one of the greatest calamities that could possibly happen in these mines, the following general description may be interesting:—

A large tank or reservoir is erected at surface, near the shaft, which is kept full of water, and by means of iron pipes the water is conveyed down the shaft. Supplementary tanks are provided underground where necessary. At every level connected with the shaft there is either a branch iron pipe or a strong hose, attached to the vertical pipe, the supply of water being, of course, regulated by prover valves or stop-cocks.

The pipes and hose are arranged so as to command the whole of the timbered shafts and the main ladder-ways connecting the main levels with the escape shafts.

Responsible men will be placed in charge of the fire-hose, &c., in order that all the connections belonging thereto may be always kept in an efficient state.

At surface steps are being taken to ensure, under all circumstances, a continuous supply of water to the tanks or reservoirs, should the hose be in use underground.

At both mines hydrants are also being laid on at surface, to command the buildings and machinery; and at Kimberley Mine there is one of Merryweather's fire engines, with all the latest improvements. It is claimed for this engine that a pressure of 100 lbs. of steam can be raised in 6 minutes, and that it is calculated to deliver a gallon of water per second. It will be made available for pumping a supply of water from the waterworks main to the tanks or reservoirs at the shafts, if required.



## SYSTEM OF UNDERGROUND WORKING.

A new system of underground working is now being adopted, which, I think, is a decided improvement on that previously practised.

Formerly levels, or offsets, 30 feet apart, were driven at right angles from the main levels. As soon as a distance of from 10 to 15 feet had been reached, the level was opened out to a "chamber," about 15 feet wide and 15 feet high. A rise was then put up from this chamber to the level above, a further height of 15 feet. These large chambers were very dangerous, greatly increasing the difficulty of "roof-trimming," and such a long "reach" of ground being opened out, rendered the falls of roof very common; and the main levels were much weakened, owing to the smallness of the pillars of ground standing between.

At present the levels to the right and left of the main levels are driven the whole distance, either to the centre of the block of blue ground or to the surrounding hard rock, as the case may be. A rise is then put up to the level above, additional levels being driven where necessary, and the ground is stoped back towards the main level, taking away all the ground as they recede, instead of leaving pillars, as on the former system, to be subsequently taken away, which was both troublesome and dangerous.

Instead of the trucks being filled, &c., in the dangerous chambers, as formerly, they are now filled in ordinary levels, which is much more safe; and I think that accidents from fall of roof, which were so common and dangerous under the old system of "chambering," will be of much less frequent occurrence where the new system is carried out.

Mining at North East Bultfontein, New Gordon, Otto's, and St. Augustine's Mines, is in the early stage of underground development, and there is therefore nothing special to note about them.

## RETURN OF MACHINERY.

I annex a return of machinery at the various mines at the end of 1889.

THOS. QUENTRALL,

Mining Engineer.



RETURN of Machinery in position at or about the Kimberley, De Beer's, Du Toit's Pan, Bultfontein, Otto's, and St. Augustine's Mines at the end of 1889 :—

	Kimberley Mine.	De Beer's Mine.	Du Toit's Pan Mine.	Bultfontein Mine.	Otto's Mine.	St. Augustine's Mine.	Grand Total.
Engines driving Hauling Gears :							
Number ... ..	10	3	11	6	1	1	32
Nominal Horse-power	347	130	204	101	30	8	820
Engines driving Washing Gears :							
Number ... ..	2	6	8	1	1	1	19
Nominal Horse-power	55	105	112	30	10	8	320
Pumping and other Engines :							
Number ... ..	17	6	10	3	1	1	38
Nominal Horse-power	207	140	70	26	6	3	452
Total Engines at each Mine :							
Number ... ..	29	15	29	10	3	3	89
Nominal Horse-power	609	375	386	157	46	19	1592



## ANNEXURE II TO REPORT I.

Inspector of Mines Office, Kimberley,  
25th January, 1890.

SIR,—Subjoined I have the honor to submit to you a report showing the number of persons killed and injured by the use of explosives in the different mines during the year ended the 31st December, 1889 :—

## KIMBERLEY MINE.

*Europeans*: injured 3; *Coloured*: killed, 3; injured, 6.

On the 19th February an explosion occurred in a rock shaft, which was being sunk in the "hard rock" on the margin of the mine, by which one European was injured, 3 coloured killed, and 6 coloured injured.

This explosion was caused through the men drilling into a quantity of unexploded gelatine.

From enquiries made and examination of the spot immediately after the explosion occurred, the conclusion arrived at was that, the rock having fissures in it, some cartridges of gelatine fell into a fissure at the time holes were being charged for blasting, and were not exploded when the charged holes were exploded, as there was a fissure where the explosion occurred, and the evidence at the inquest proved that all the holes charged were exploded.

The two other Europeans received their injuries through pure accidents.

## DE BEER'S MINE.

*Europeans*: killed, 1; injured, 3; *Coloured*: killed, 8; injured, 4.

Seven of the coloured were killed and two injured through drilling into unexploded charges, five of them being killed and one injured in less than two months.

At this mine miners had been allowed to buy their explosives from local agents, who sent them into the mine. This had been satisfactory, as no advantage had been previously taken to introduce into the mine any but certain explosives by local agents.

At the time of these accidents local agents took advantage of this, and sent into the mine for miners to experiment with a new explosive called *gelignite*, without consulting or obtaining the permission of the management to do so.

Gelignite requires a more powerful detonator to explode it than dynamite does, and the inference drawn was that the miners got the different detonators for exploding gelignite and dynamite all mixed up together, with the result that they used detonators for the explosion of the gelignite which should only have been used for the explosion of dynamite, the result being that such detonators failed to explode the gelignite.

The General Manager (Mr. Gardner F. Williams) issued instructions that only certain explosives were to be allowed to enter the mine (excluding gelignite), with the result that no accident of drilling into an unexploded charge has since occurred, so that the action of the General Manager appears to have been fully justified, and it is undoubtedly a dangerous practice to allow a large number of miners, who are constantly borrowing from each other, to bring a number of different explosives into the mine.

At the same time local agents sent slow and quick burning fuses into the mine, the result being that one European and one coloured were injured through such fuses getting mixed.

One coloured was killed and one injured through disobeying orders.

One European was injured through the carelessness of another, who was discharged for such carelessness.

The others were pure accidents.



## DU TOIT'S PAN MINE.

*European*: injured, 1; *Coloured*: injured, 4.

The European was injured through contravening the regulations, and was fined £5 and costs for such contravention.

Three of the coloured were injured through disobeying orders, and the other through a pure accident.

## BULTFONTEIN MINE.

*Europeans*: killed, 2; *Coloured*: killed, 4; injured, 3.

One European was injured, four coloured killed, and one injured through a driller, named Joseph Consla, recklessly exploding a charged hole in a high face during working hours, and throwing the ground down upon persons working in the claims below.

Consla was committed for trial, but was discharged, after being severely reprimanded by the Judge, owing to the absence of the principal witness, a native.

The other European and two coloured were injured through pure accidents.

## OTTO'S KOPJE.

*Coloured*: 1 injured, through disobeying orders.

## ST. AUGUSTINE'S MINE.

Nil.

R. A. SKELDING,

Inspector of Explosives.

## II. REPORT OF INSPECTOR OF CLAIMS, BARKLY WEST, FOR THE YEAR 1889.

It is always pleasant to be enabled to report progress, and as regards revenue, the year 1889 shows considerably in advance of its predecessor.

The revenue for the year 1889, inclusive of the revenue derived from the alluvial diggings in the Kimberley Division, amounts to £6,144 13s., made up as follows:—

	£	s.	d.
Claim Licences ... ..	5,046	0	0
Miners' Certificates ... ..	496	15	0
Transfer Dues ... ..	23	5	0
Protection Certificates ... ..	89	13	0
Rent Deposit Sites ... ..	489	0	0
	<hr/>		
	£6,144	13	0

being an increase of £1,010 on the revenue received in 1888.

The approximate weight and value of diamonds (data kindly supplied by the Detective Department) imported into Kimberley from the Barkly division during the year were 29,492½ carats, valued at £78,284 19s. 9d.

The order in which the alluvial diggings stand as regards revenue has undergone little change; Gong Gong still first with a revenue of £1,877 15s., followed by Waldeck's Plant (Keiskama's included), with £648 15s., Robinson's Kopje No. I, an alluvial digging in the Kimberley division, taking third place, with £548 15s., closely followed by Hebron with £544 10s., Longlands dropping into fifth place with £308 10s.



## DEEP ALLUVIAL.

Claims in deep alluvial have for some time past been attracting considerable attention, especially those of Gong Gong and Robinson's Kopje No 1.

The Vaal River Diamond Company, Limited, of London, having purchased the farms Gong Gong and Bucklands, are now working proclaimed ground on the former farm. With a block of 186 claims in surveyed Gong Gong, good work has been done. There, with an open face of about 90 feet in width, a depth of 40 feet has been reached, water level, sinking still continuing in order to strike the payable layer, which in many places in the same block has been proved to exist on and a few feet above the bed rock. This layer will probably be reached at a depth varying from 65 to 75 feet, in some places even deeper.

The machinery, &c., in use by this company are:—One 12 horse hauling engine, one 8 horse engine, one gravitating machine and cylinder; there is also a double inclined tram from top of platform to present bottom of face, which will be carried down (as work progresses) to bed rock.

Up to 31st December 148½ carats weight of diamonds had been obtained, valued at £1,000.

There is also the Graham's Town Diamond Prospecting Company (lately formed), which, in addition to certain prospecting rights provisionally granted, has secured 20 claims, also in the deep surveyed alluvial.

In the deep alluvial of the proclaimed digging of old Gong Gong (unsurveyed) a Kimberley syndicate has secured 50 claims, and work is being pushed on vigorously.

On this farm, also, in the recently proclaimed extension of old Gong Gong Diggings, the Vaal River Diamond Mining Company, Limited, hold 75 claims in the River, with a corresponding number on the proclaimed digging of Cawood's Hope, lying immediately opposite.

From a spot a little above what is known as the Gong-Gong Falls (where the river tumbling over a break in the bed rock rushes along a narrow channel, river made, between walls of black rock—*bed rock*—for a distance of 120 yards or thereabouts, thence opening into what might be termed a small lagoon, with an ever-increasing depth of water of from 6 feet from where it first falls to 35 feet where it touches the lagoon), a long cutting has been made, so that in dry seasons the waters may be diverted from the channel and lagoon (wherein payable diamondiferous deposit is believed to exist) to re-enter at a point immediately below where the river suddenly shallows to a depth of a few feet. During the short period last season that the company were enabled to work—and then but a small portion of this deposit—diamonds to the value of £1,250 were obtained. These claims are now protected by a monthly payment of one shilling per claim per month, under provisions of Section XXIX, Division II, of Act 19 of 1883.

In the deep alluvial of Robinson's Kopje No. I, situate in the Kimberley division, some 200 claims are licensed by various diggers; these claims will doubtless ere long be taken over by different syndicates, and worked on a more extensive scale than is in the power of the individual digger.

## MINES PROCLAIMED DURING THE YEAR 1889.

One new mine has been proclaimed during the year, under the name of the "Washington Mine." This mine proclaimed by Proclamation No. 27, of 13th February, 1889, and allotted on 25th February, 1889, is what is known as a dry mine, and contains, as per official plan, 240 claims. It is situate on Farm 46, Government Reserve, is distant from the town of Barkly 18 miles, and between 3 and 4 miles east of Likatlong on the Hartz River. 138 claims in the mine are still licensed.



## LEASES OF ABANDONED DIGGINGS OR MINES SOLD DURING 1889.

### NEWLANDS No. 2.

This mine, which had already been partially developed at considerable expense, all holdings having been given up, was declared abandoned under Proclamation No. 37 of 28th February, 1889, and on the 14th of March, 1889, the lease of one morgen was adjudged to Mr. George Arthur Montgomery Tapscott, of the firm of Hill & Paddon, of Barkly, at the upset price. A syndicate is now in course of formation with a large working capital, those interested, despite the large outlay already incurred, still being sanguine as to future results.

## LEASES IN EXISTENCE PRIOR TO 1889.

### PNIEL.

The whole of the abandoned alluvial diggings known as Pniel, in extent 13 morgen 430 square rods, leased to Mr. Henry William Stone, of Kimberley, on the 27th January, 1888, but little work has been done, nor do I know what the intention of the lessee is as regards this digging.

### NEWLANDS No. I.

The lease of the two morgen of ground in this mine purchased by Mr. James Murray, of Newlands, has reverted to Government, the lessee refusing to sign the lease or fulfil conditions of purchase.

On the one morgen owned by G. Paton & Company no work has been done since September, 1888, nor am I aware if any work in the near or far future is contemplated.

### WRIGLEY'S KOPJE.

This mine, leased originally to Mr. Martin Brodrick, of Kimberley, is now in the hands of a syndicate, and, in conjunction with certain landed property purchased, is under offer in England, as a Diamond Mining and Estate Company. In the event of flotation, a large working capital will be set apart for working the mine on a proper mining basis.

### VICTORIA MINE.

During the past year the holdings in this mine have been amalgamated, and the lease transferred to the trustees of the Vaalton Syndicate, Limited, Messrs. Edward Dicey, C. B., and Mr. B. Green Lake. Mr. George Kilgour, the managing director, is now in Barkly, and is about to commence operations to thoroughly test the value of the yellow and blue ground. Mr. Kilgour informs me that the Vaalton Syndicate propose (the consent of the proprietors of the farms Good and Bad Hope obtained) to carry out the valuable suggestions made in the fourth and fifth paragraphs of the Report of the Inspector of Mines, Kimberley (Capt. W. C. C. Erskine) for the year 1888. [G. 22—'89] pp. 1 and 2.

### BORRELL'S KOPJE.

The five morgen leased in this mine have been amalgamated and taken over by a syndicate, for the purpose of forming a company, and I am advised that, on the formation of the company, work will at once be commenced, and on a large scale.

There is no material difference in the number of the digging population, and wages are about the same as in 1888.

### PROSPECTING.

Numbers of prospectors are at work throughout the district, prospecting for both gold and diamonds, and, judging from the present healthy state of the new diggings, not only as regards the prevailing high price of diamonds and the influx of diggers likely to occur thereby, but from declarations made lately of diamonds found, the year 1890 opens with fair promise of a still increasing revenue.

W. FRANKLIN, Inspector of Claims.



## (ANNEXURE II TO REPORT No. II.)

## BARKLY WEST.

RETURN showing the Amount of Revenue received from the different Diggings during the year 1889.

Name of Digging or Mine.	Amount of Licences.	Amount of Miners' Certificates.	Total.
	£ s. d.	£ s. d.	£ s. d.
Spence's Kop .....	5 0 0	1 5 0	6 5 0
Liversides .....	40 10 0	2 15 0	43 0 0
Wedburg .....	135 0 0	27 15 0	162 15 0
Robinson's I .....	505 10 0	43 5 0	548 15 0
Webster's Kopje .....	12 10 0	2 0 0	14 10 0
Cawood's Hope .....	40 0 0	5 10 0	45 10 0
Waldeck's Plant .....	268 0 0	43 15 0	311 15 0
Keisakanna S. ....	292 10 0	44 10 0	337 0 0
Niekerk's Rush .....	135 10 0	28 0 0	163 10 0
Jonas Kopje .....	27 10 0	3 10 0	31 0 0
Welsh's Prospect.....	13 0 0	2 0 0	15 0 0
Hebron .....	451 0 0	93 10 0	544 10 0
Klipdam .....	30 0 0	5 15 0	35 15 0
Holpan.....	5 10 0	2 5 0	7 15 0
Van Zoelens Laagte...	11 0 0	1 15 0	12 15 0
Jacob's Prospect .....	18 0 0	3 10 0	21 10 0
Klip Drift .....	78 10 0	46 0 0	124 10 0
Good Hope .....	143 10 0	21 15 0	165 5 0
Bad Hope ..	10 10 0	2 5 0	12 15 0
Gong Gong .....	1860 0 0	17 15 0	1877 15 0
Union Kopje .....	24 0 0	4 10 0	28 10 0
Keisakanna N.....	15 10 0	2 15 0	18 5 0
Forlorn Hope .....	2 0 0	0 10 0	2 10 0
Longlands .....	254 0 0	54 10 0	308 10 0
Esterhuisen's .....	1 10 0	—	1 10 0
Winter's Rush.....	76 0 0	13 15 0	89 15 0
Delpport's Hope .....	90 0 0	22 5 0	112 5 0
Newland's No 2 .....	11 0 0	—	11 0 0
Washington Mine ...	489 0 0	—	489 0 0
	5046 0 0	496 15 0	5542 15 0
Protection Certificates ...	...	...	89 13 0
Transfers ...	...	...	23 5 0
Rent Deposit Sites ...	...	...	489 0 0
Grand Total ...	...	...	£6144 13 0

W. FRANKLIN,  
Inspector of Claims.



(ANNEXURE I TO REPORT II).—BARKLY WEST.

CLASS I.—Mines and Diggings on Crown Lands.

MINES AND DIGGINGS.	Claim Licenses.		Depositing Sites.		When, and under what Proclamation proclaimed.	When, and under what Proclamation abandoned.	When Leased, and by whom.	REMARKS.
	Government.	Proprietor.	Government.	Proprietor.				
Borrell's Prospect Mine ..	Whole ..	Nil. ..	Whole ..	Nil. ..	Proc. 166 of 3rd Oct., 1883.	259 of 28th Nov., 1884.	2 morgen on 26th Sept., 1887, to C. Droste, 2 Morgen on 26th Sept., 1887, to T. A. Higson. 1 Morgen on 28th March, 1888, to E. M. Litkie and E. W. Heckrath.	
Jonas Kopje .....	"	"	No Depositing Sites. do.	do.	Proc. 131 of 1885.	Still open.		Extended to all Alluvial Deposits on the Hebron Com-montage by Proc. 237 of 1887.
Welsh's Prospect .....	"	"			Proc. 23 of 27th Jan., 1887.			
Hebron .....	"	"			Proc. 34 of 28th Nov., 1871.			
Klipdrift .....	"	"	do.	do.	Proc. 39 of 10th Jan., 1872.	"		Klipdrift by Proc. 39 of 10th Jan., 1872, extends on North Bank, Vaal River, from Up-per Klipdrift to Good Hope.
Forlorn Hope .....	"	"	do.	do.	Proc. 34 of 28th Nov., 1871.	"		
Longlands .....	"	"	do.	do.	Proc. 35 of 8th Dec., 1871.	"		Proc. 35 of 8th Dec., 1871, also proclaims area between Winter's Rush and Delpot's Hope, one mile north of Vaal River, a public digging.
Esterhuisen's Rush .....	"	"	do.	do.	Proc. 34 of 28th November, 1871.	"		
Winter's Rush .....	"	"	do.	do.	"	"		
Delpot's Hope .....	"	"	do.	do.	"	"		
Washington Mine .....	"	"	Whole ..	Nil ..	Proc. 27 of 13th Feb. 1889.	"		



CLASS II.—Mines and Diggings on Property with reservation of Minerals to the Crown.

MINES AND DIGGINGS.	Claim Licences.		Depositing Sites.		When, and under what Proclamation proclaimed.	When, and under what Proclamation abandoned.	When Leased, and by whom.	REMARKS.
	Government.	Proprietor.	Government.	Proprietor.				
Victoria Mine .....	Whole ..	Nil ....	Nil .....	Whole ..	Proc. 172 of 13th Oct., 1881.	Proc. 4 of 4th Jan., 1884.	One Morgen to Martin Broderick, 26th Sept., 1887. Two Morgen to Carl Droste, 26th Sept., 1887, the remaining portion of the mine leased to George Kilgour, 5th March, 1888. One Morgen leased to G. Paton, 12th May, 1884.	Amalgamated and transferred to Trustees, Vaalton Syndicate.
Newlands No. 1. ....	"	"	"	"	Proc. 191 of Nov., 1881.	Proc. 19 of 24th Jan., 1884.	One Morgen leased to G. A. M. Tapscott, 14th March, 1889.	
Newlands No. 2. ....	"	"	"	"	Proc. 58 of 6th April, 1882.	Proc. 37 of 25th Feb., 1889.	Two Morgen to M. Broderick, 28th July, 1887. One Morgen to M. Broderick, 14th November, 1887.	Transferred to Trustees, Diamond and Estate Company, Limited.
Wrigley's Mine .....	Half ....	Half ....	"	"	Proc. 55 of 12th April, 1883.	Pro. 248 of 23rd Oct., 1884.		
Good Hope .....	Whole ..	Nil ....	No Depositing Sites.		Proc. 34 of 28th Nov., 1871.	Still open.		
Bad Hope .....	"	"	do.		"	"		
Gong Gong .....	Half ....	Half ....	do.		"	"		
Union Kopje .....	"	"	do.		"	"		
Keisakanna N. ....	"	"	do.		"	"		
Jacob's Prospect .....	"	"	do.		Proc. 54 of 1886.	"		Old Gong Gong further extended by Proc. 228 of 1887. Only that portion open on Union Kopje Farm Further extended by Proc. 59 of 1887.
Holpan .....	"	"	do.		Proc. 84, May 5, '88.	"		Further extended under Authority of Government Letter A198, of 24th June, 1886.
Klipdam .....	"	"	do.		Proc. 194 of 1888.	"		
Van Zoelen's Laagte .....	"	"	do.		Proc. 193 of 1888.	"		



(ANNEXURE I TO REPORT II).—BARKLY WEST.—(continued).

CLASS III.—Mines and Diggings on Property on which there is no reservation of Minerals to the Crown.							
	Half	Half	No Depositing Sites.	Proc. 33 of 28th Nov., 1871.	243 of 1887.	To William Henry Stone on 27th January, 1888.	Keisakanna South merely extension of Waldeck's Plant, called Keisakanna South for convenience. Defined by Proclamation 195 of 29th June, 1882.
Priel .....							
Webster's Kopje .....	"	"	d.o.	"	Still open.		
Cawood's Hope .....	"	"	d.o.	"	"		
Waldeck's Plant, including Keisakanna S. ....	"	"	d.o.	Proc. 53 of 4th Sept., 1872.	"		
BlueJacket, or Niekerk's Rush	"	"	d.o.	Proc. 33 of 28th Nov., 1871.	"		

CLASS IV.—Alluvial Diggings in the Kimberley Division on Property upon which there is no reservation of Minerals to the Crown.							
	Half ....	Half ....	No Depositing Site.	Proc. 129 of 1886.	Still open.	Wedburg further extended by Proclamation 51 of 1887.	
Spence's Kopje .....	"	"	d.o.	"	"		
Liversides .....	"	"	d.o.	"	"		
Wedburg & Robinson, No. II.							
Robinson's No. I. ....	"	"	d.o.	Proc. 89 of 1887.	"		

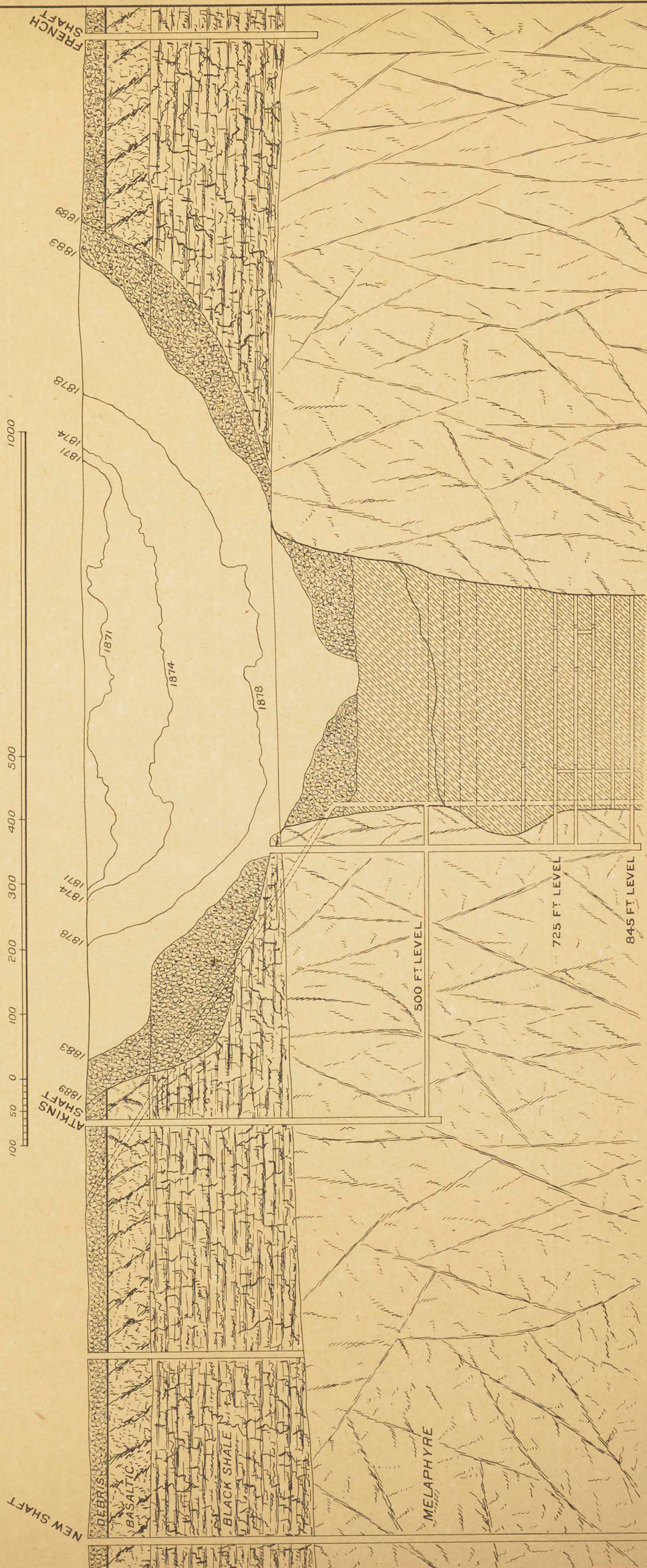
W. FRANKLIN,  
Inspector of Claims.



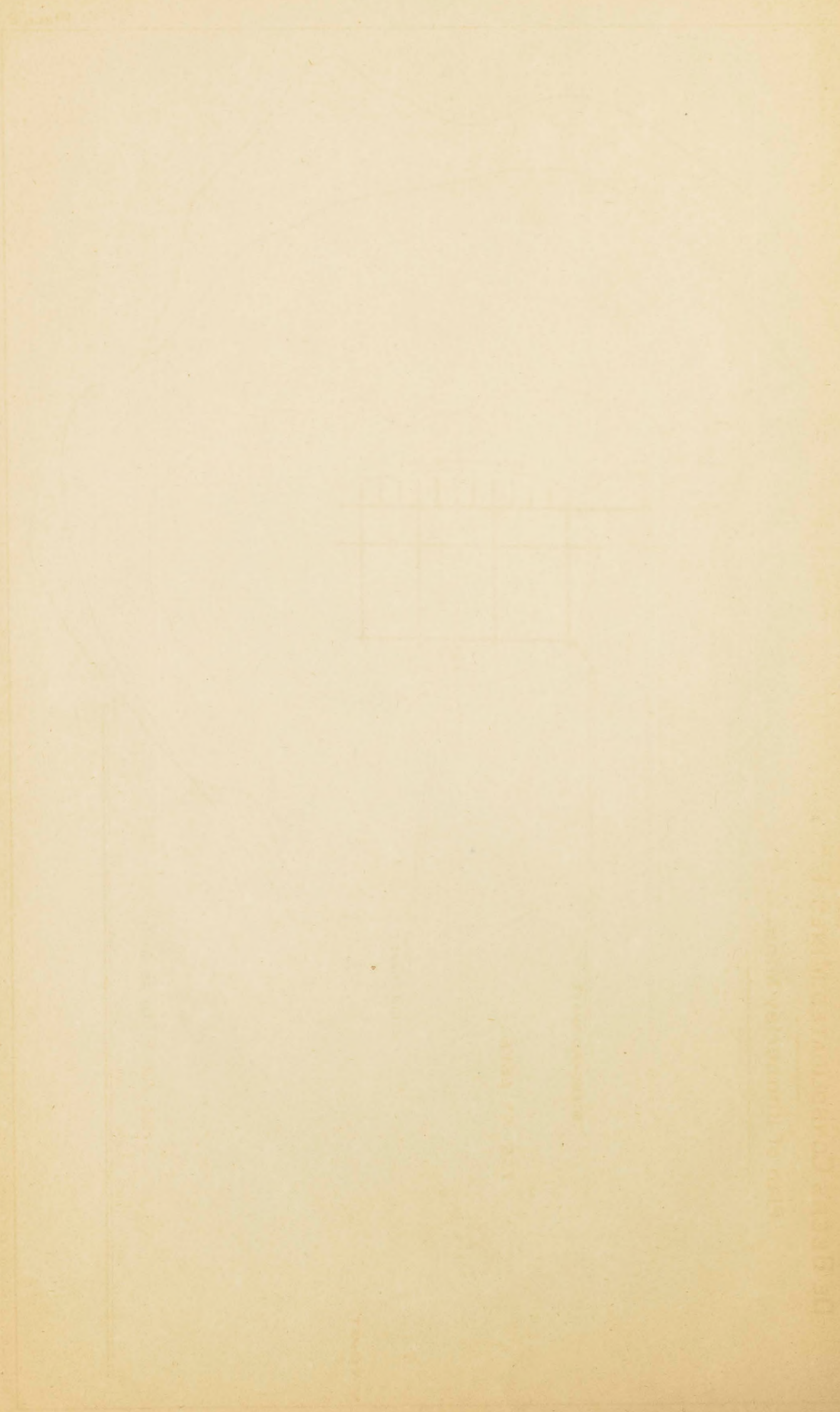
# DE BEER'S CONSOLIDATED MINES, LTD.

## Section through Kimberley Mine.

Scale 200 F<sup>t</sup>. to an Inch.



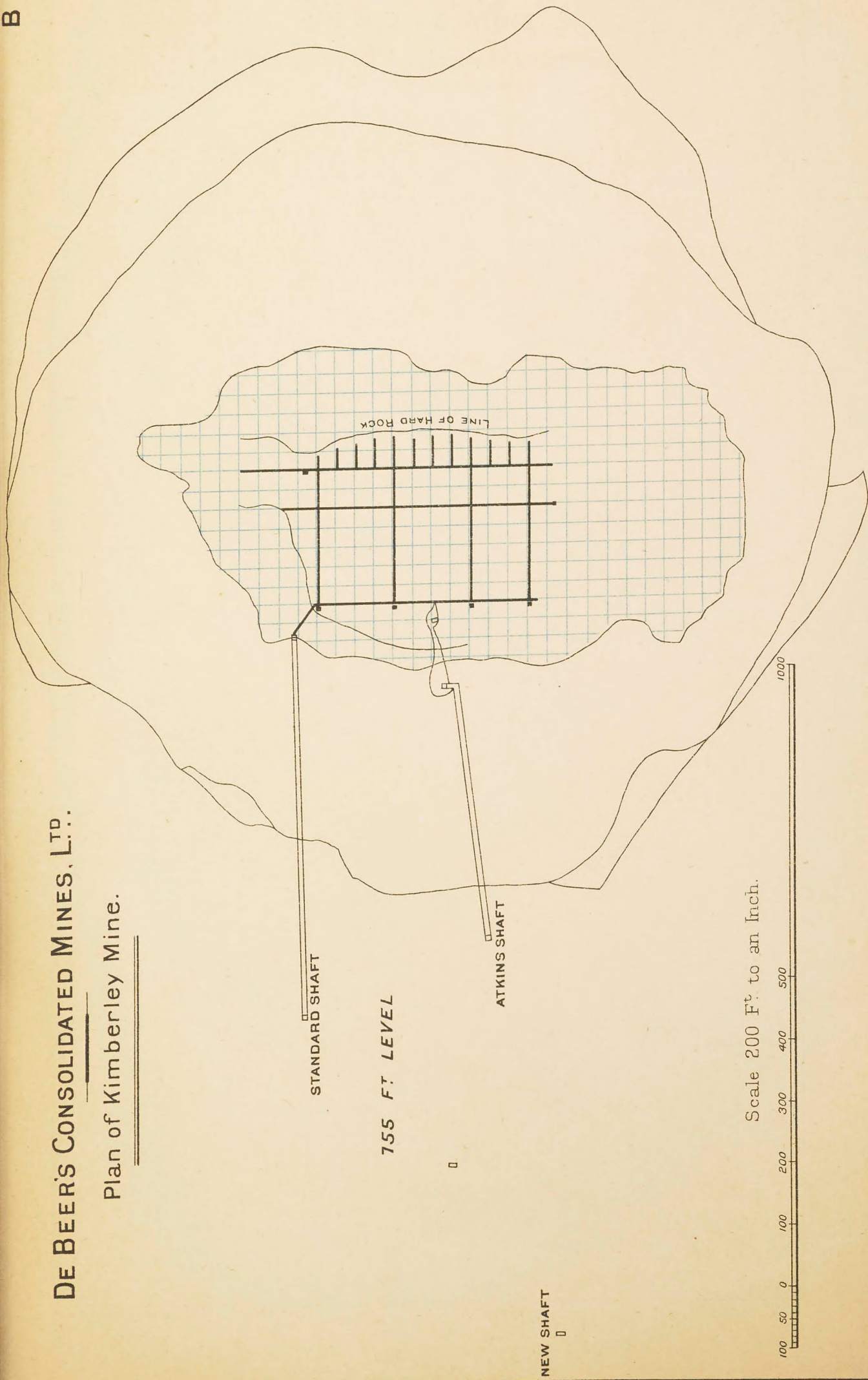






DE BEER'S CONSOLIDATED MINES, LTD.

Plan of Kimberley Mine.





# DE BEER'S MINE

Plan showing Contour of De Beers Mine

Scale 1:10,000

1905

De Beers Mine



De Beers Mine



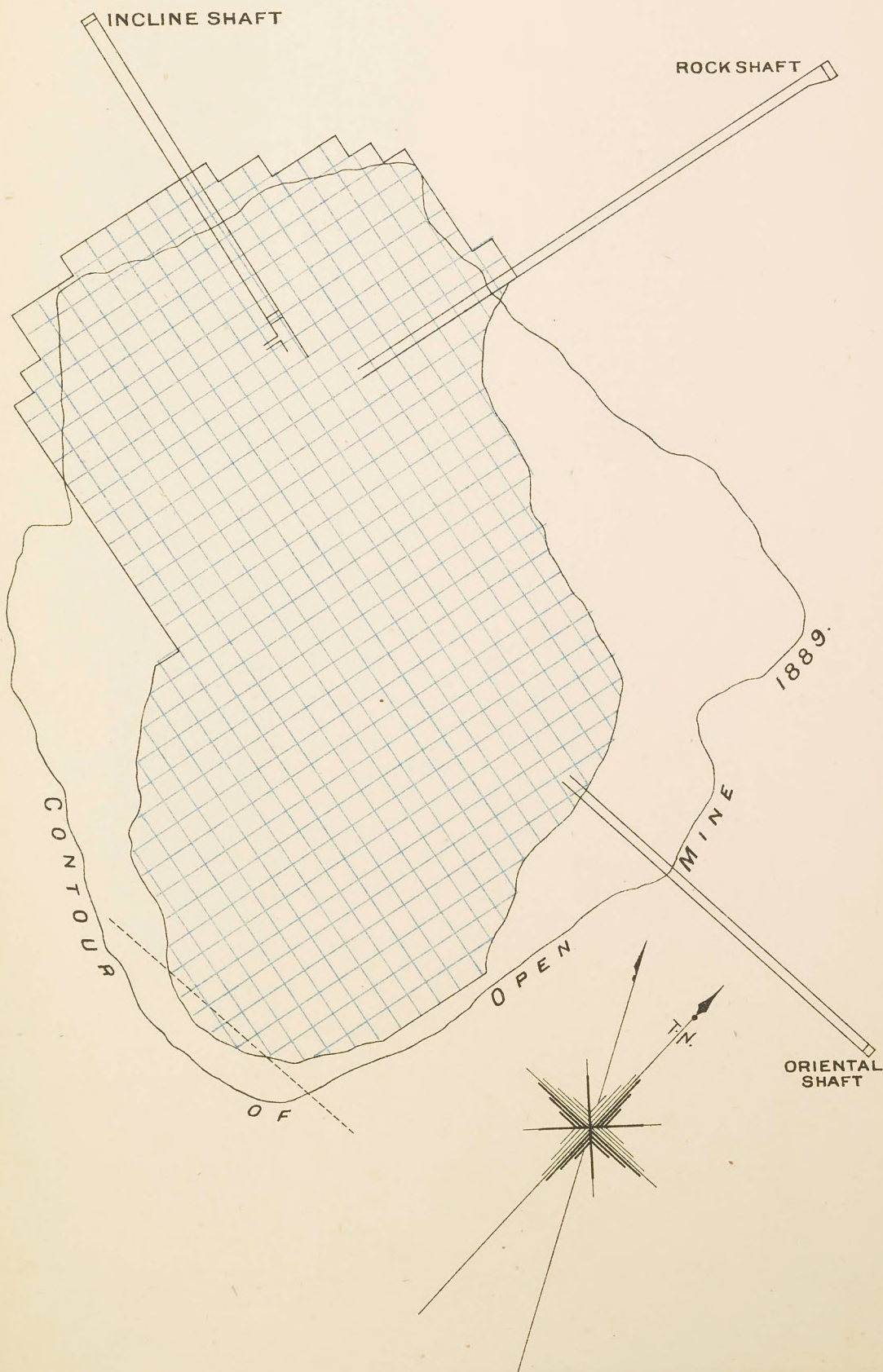
DE BEER'S MINE  
1905



# DE BEER'S MINE.

Plan shewing Contour of Open Mine.

Scale 200 Feet = 1 Inch.





Page 10

Geological Section  
of the B. & N. R. R. at  
DE BEER'S MINE

Plan showing Contour of Open Mine

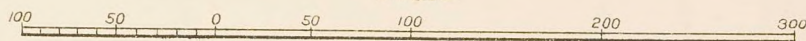
The mine is situated on the





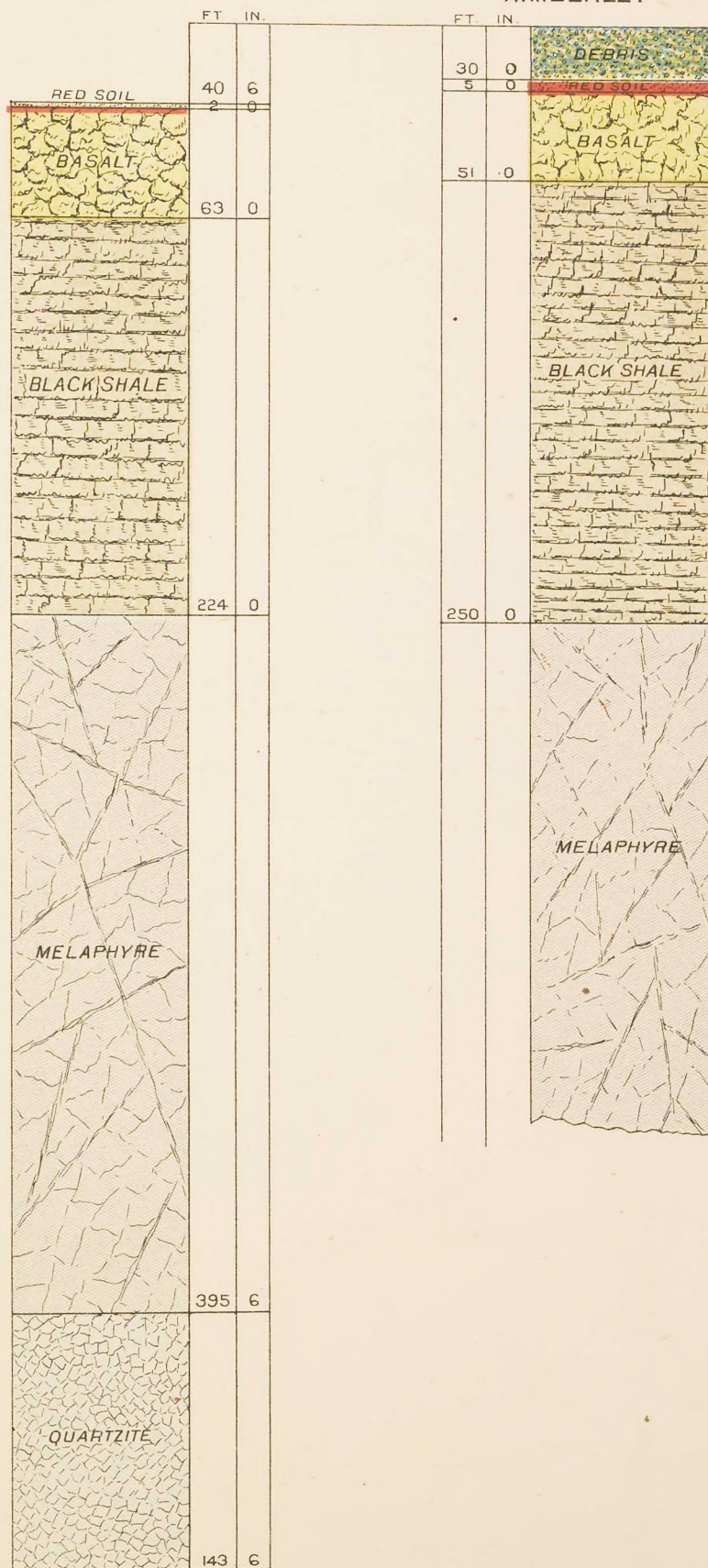
# Geological Sections of DE BEER'S AND KIMBERLEY ROCK SHAFTS.

Scale.



## DE BEER'S

## KIMBERLEY









# FAIRBURN BEELEY BOILER.

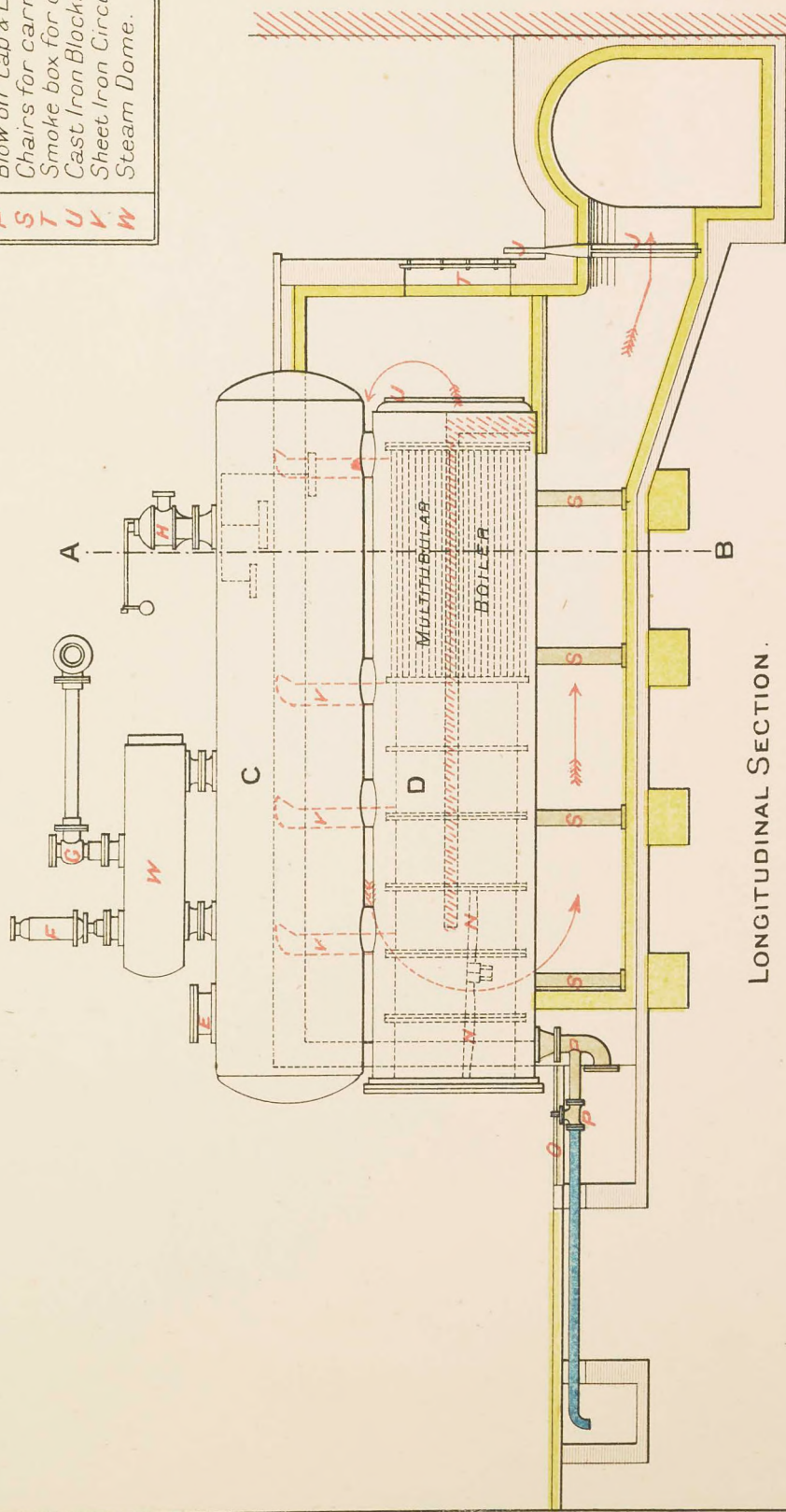
— Scale  $\frac{1}{8}$ " = 1 Foot. —

E. F.

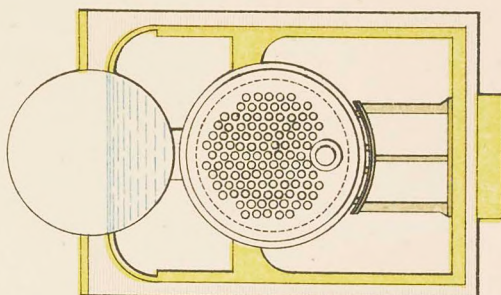
## REFERENCE

Round Manhole.  
Double Pendulous Dead Weight Safety Valve.  
Steam Nozzle.  
High Steam & Low Water Safety Valve  
Dampers & Frames.  
Firefront, doors, bars & bearers complete  
Floorplates & Frames.  
Blow off tap & Elbow pipe.  
Chairs for carrying Boilers.  
Smoke box for cleaning the Tubes.  
Cast Iron Blocks for protecting Bolts.  
Sheet Iron Circulating Pipes.  
Steam Dome.

E F G H J N O P S T U V W



LONGITUDINAL SECTION.



SECTION THROUGH LINE A - B.





Fig. 1. Section of boiler  
B. A.

Fig. 2. Section of boiler  
B. A.

Fig. 3. Section of boiler  
B. A.







